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ABSTRACT

While there are severe limitations on the availability, comparability, and reliability of education statistics for the United States and other major foreign nations, a comparison of data reveals that the relative ranking of the United States among other nations with respect to educational participation in general is high, but that it is low in certain specific areas. The major source of data for this study is the "1987 Statistical Yearbook" of the United Nations Educational, Scientific, and Cultural Organization. Data are compared for three areas: participation (15 tables and charts); expenditures (11 tables and charts); and achievement (8 tables and charts). At the gross enrollment rate, the United States is among the highest in the world at the secondary level, and the highest at the postsecondary level. The pupil-teacher ratio for the United States however, is high when compared to the other nations. The United States ranks relatively high in both share of gross national product (GNP) and of total government expenditures that are devoted to education, although other nations place a higher emphasis on spending at the primary and secondary educational levels. Achievement scores for the United States were relatively lower at higher age/grade levels in all subject areas, particularly in mathematics and foreign language (French). Tests were sponsored by the International Association for the Evaluation of Educational Achievement. A brief discussion and analysis section on the various tables and charts in each of the three data sections helps to provide meaningful comparisons of the data. (PPB)

CRS Report for Congress

COMPARATIVE EDUCATION: STATISTICS ON EDUCATION IN THE UNITED STATES AND SELECTED FOREIGN NATIONS

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COMPARATIVE EDUCATION: STATISTICS ON EDUCATION IN THE UNITED STATES AND SELECTED FOREIGN NATIONS

SUMMARY

There are severe limitations on the availability, comparability, and reliability of education statistics for the United States and major foreign nations. Nevertheless, data on selected aspects of educational participation, expenditure, and achievement exist that may be meaningfully compared. This report provides a variety of such statistics, accompanied by a brief discussion and analysis. The nations included in the report are Australia, Canada, the People's Republic of China, West Germany, France, Italy, Japan, Mexico, the Soviet Union, Sweden, the United Kingdom, and the United States.

The relative ranking of the United States among these nations is high with respect to educational participation in general, especially at the postsecondary level. However, in certain specific areas, such as the proportion of postsecondary enrollments or graduates in the sciences and mathematics, or number of days in the public primary and secondary school year, the United States' ranking is among the lowest for the 12 nations.

Of all the data included in this report, the comparability problems are greatest with expenditure statistics. On most measures of educational expenditures, the United States again ranks relatively high. Only Sweden and Canada exceed the United States' percentage of gross national product (GNP) devoted to education, while only Japan spends a higher percentage of government expenditures for education, and only Sweden has higher estimated expenditures per pupil for elementary and secondary education. An exception to this general pattern is the government share of student charges for higher education, an area in which several of the nations ranked above the United States.

The currently available data on educational achievement that can be appropriately compared include scores of upper primary and secondary students on tests in mathematics and science. The scores of students in the United States are among the lowest on most of these tests, especially among students in their final year of secondary school and on the mathematics tests. Analyses of the comparative status of American education focus on possible explanations for the United States' relatively low ranking on these achievement tests. Explanations that have been offered include arguments that: achievement is highest in nations with selective and differentiated systems of secondary education, unlike the comprehensive system in the United States; there are specific weaknesses in the mathematics curriculum in the United States, compared to those of other developed nations; and American students spend less time in school than those in other developed nations, and devote relatively less of their classroom time to mathematics and science.

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COMPARATIVE EDUCATION: STATISTICS ON EDUCATION IN THE UNITED STATES AND SELECTED FOREIGN NATIONS

I. INTRODUCTION AND DISCUSSION OF GENERAL DATA LIMITATIONS

Introduction

This report provides a compilation, discussion, and brief analysis of comparative education statistics for the United States and 11 foreign nations. Data on broad aspects of educational participation, expenditure, and achievement are included, but the statistics are limited to those that are current, reliable, and compiled on a consistent basis for each of the nations. Many important aspects of educational system characteristics and performance are not included in this report, since no comparative data--or no data meeting these criteria--are currently available.

In addition to the United States, data are presented--where available--for Australia, Canada, the People's Republic of China, the Federal Republic of (West) Germany, France, Italy, Japan, Mexico, the Soviet Union, Sweden, and the United Kingdom (Great Britain).[1] These nations were selected because they are generally similar to the United States in economic development (e.g., Japan, France, Italy, Federal Republic of Germany, United Kingdom, Australia, Sweden), are major global political or military powers (e.g., the Soviet Union, People's Republic of China), and/or are neighbors of the United States (Mexico, Canada).

The first section of the report presents general cautions and limitations affecting these and other comparative education statistics. This is followed by the data, which are presented in both tabular and, where appropriate, graphic form. The data are grouped under the categories of participation, expenditures, and achievement. A third and final section provides a discussion and brief analysis of the statistics, with an emphasis on achievement data.

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[1]Regarding education data for the United Kingdom, it should be kept in mind that the education system of Scotland is separate from that of England and Wales. In many cases, this report provides data for the United Kingdom that are averages of separate figures for England/Wales and Scotland, or that apply to England and Wales only. Explanatory footnotes are provided in these situations.

General Data Limitations

The following tables and graphs contain the latest available, comparable data on several aspects of the education systems of the United States and 11 other nations. The data cover major aspects of each nation's educational system for which relatively recent, comparable data are available. Where possible, data have been compiled for all nations from the same source. Nevertheless, in several cases, data from a common source have been supplemented by data obtained from each nation's education department or ministry. Such supplementary sources were used in cases where they provided more recent information, or where the general source contained no data for the nation. Finally, for several of these data categories, we have been unable to obtain any information for some of the nations. This has resulted in cases where the nation chose not to participate in a special survey (e.g., the science and mathematics achievement assessments discussed in this report), or where repeated review of available publications and requests to the nation's Washington embassy and other organizations failed to elicit the desired information.

Most of the data in these tables and graphs are for calendar year 1985, or academic/school year 1984-85. These are generally the latest available data in the most recent (1987) edition of the publication used as a primary source for these statistics, the annual Statistical Yearbook of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In some cases, the use of data earlier than 1985 for certain nations compounds the difficulties associated with comparing these figures. In all cases, the data used are the latest available to CRS,[2] and the use of data from years other than 1985 is noted.

UNESCO Data

Most of the international expenditure and enrollment data have been compiled in the 1987 Statistical Yearbook, published by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In most cases, the latest available data from this Yearbook are from 1985. However, for some countries the most recent data available are from 1982-84 only.

There are other potential problems with using the UNESCO data. The most serious of these problems is the potential inaccuracy of the reported statistics. In some instances, the data in the Yearbook do not agree with data supplied by other sources. In other cases, the Yearbook has no expenditure or enrollment data at all. Unfortunately, in several of these cases, alternative data sources could not be found. Potential remaining errors

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[2]The one exception to use of the latest available data is use of 1984-85 data even when more recent information is available for the United States, for the sake of comparability with data for other nations.

and omissions may limit the ability to compare the United States' standing against other countries' educational systems.

Using only expenditure, enrollment, and achievement statistics also limits comparison capabilities. These data may not accurately reflect the strengths or weaknesses of educational systems. This is especially true of the expenditure data; while UNESCO collects data on the amounts of money each country spends on education, it cannot analyze how effectively these allocations are used, or differences in what goods and services can be purchased with a given level of funds. There are also differences in how the data are recorded. The United States, for example, traditionally uses average daily attendance (ADA) figures (i.e., the average number of pupils actually attending school over the year) to calculate average expenditures per student on primary and secondary education. UNESCO, however, reports only total enrollments, not ADA figures. This difference may affect our ability to accurately compare per-pupil expenditures.

Exchange Rates

The expenditure figures may also be inaccurate because they are converted to U.S. dollars by using annual average exchange rates for each country.[3] Using yearly average rates may be deceptive and inaccurate because exchange rates fluctuate constantly; thus, the U.S. dollar continuously gains or loses value against other currencies. Market currency exchange rates are affected by changes in each countries' economic conditions, fluctuating interest rates, and foreign trade balances. Further, the official exchange rates for countries with non-market economies (such as the Soviet Union and the People's Republic of China) may also be artificially high or low because these exchange rates are set by the government, and not the currency exchange market. Government-controlled exchange rates may make government educational expenditures appear higher or lower than actuality--in terms of the levels of goods and services that can be purchased--when converted to dollars at these rates.

Using market exchange rates also does not consider the purchasing power of currencies for salary earners in other countries. These exchange rates do not consider prices that either school systems, or teachers and other consumers, pay for important goods and services. It may be more accurate to consider purchasing power parity (PPP) rates for each country when comparing teacher salaries. PPP rates are the ratios of the cost of a given set of goods and services in each foreign currency to the cost of the same goods and services in U.S. dollars. These ratios attempt to reflect the

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[3]UNESCO publishes educational expenditures for each country in the country's own currency. For ease of comparison, each foreign country's educational expenditures were converted to their equivalent value in U.S. dollars. These calculations were done by using exchange rates published in the UNESCO Yearbook.

domestic purchasing power of each national currency.[4] However, official PPP rates are not available for this report, and thus, are not considered.[5]

Differences Within Nations

Using national average expenditure and enrollment data may also be misleading; these averages mask differences in spending and enrollments between regions, States or localities in each country. Such differences may affect the recorded academic achievement levels for each country. It should not be assumed, therefore, that countries with large enrollments and expenditures on education have "successful" educational systems. Other data for each nation, such as secondary school drop-out rates, should be collected and analyzed for each country before a more complete evaluation of education systems is attempted.

These data are also limited because they do not consider the fact that control of the educational systems in such nations as the United States, Canada, and the Federal Republic of Germany countries is substantially decentralized. That is, control of the day-to-day operation of individual schools and school districts, as well as authority regarding a wide range of educational policies, is left to the discretion of localities and/or "States"[6] within these countries. These States/localities control important policies (such as length of school year) which may affect educational achievement. Many of the localities or "States" in these countries also may have control over how money is spent. The expenditure data collected does not account for this control. Because of this, comparisons of expenditure data for these countries with countries whose educational system is controlled by the national government may be deceptive.

As mentioned above, the information included in this report does not address, or at least does not resolve, some important issues that limit the ability to compare educational systems, such as the structural differences in the educational systems of these nations. For example, some countries may have courses and/or levels of instruction in secondary education that other countries only offer in postsecondary education. This is especially true of mathematics and science courses, where some countries offer advanced courses as part of their secondary education curricula, but other countries do not.

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[4]Barro, Stephen M. International Comparisons of Teachers ' Salaries: An Exploratory Study. U.S. Department of Education, Office of Education Research and Improvement. p. 9-11.

[5]Purchasing power parity rates are also subject to limitations--and possible inaccuracies--due to constantly changing prices of goods and services in other countries.

[6]State in the United States, Province in Canada, or Land in the Federal Republic of Germany.

These differences in course offering may explain some of the differences in mathematics and science achievement recorded by the International Association for the Evaluation of Educational Achievement (IEA).

Length of School Year

The length of school year data are also limited. School year data are difficult to compare because some nations (e.g., Italy, Japan, and the Soviet Union) conduct school on Saturdays, although for fewer hours than on weekdays. These data do not indicate how efficiently time in the classroom is spent during the school year. Time spent on activities outside of the classroom (i.e., extra-curricular activities or homework) is also not indicated by this data. Length of school year data also do not consider the average length of the school day, or the average length of time spent in the classroom for each major subject. Such data may provide a better indication of the amount of actual learning opportunities students are given each day during the school year. And, because length of school year data only considers the "traditional" school year in each nation, other parts of the school year may be missed. These include extended summer school sessions, before or after school tutorial sessions (such as Japanese "juku"), and other times in the classroom that may not be included in the traditional school year.

Other Data Sources

In order to minimize some of these limitations, other sources of data have been used. Most of the statistics for the United States, for example, are from two sources: the 1988 Statistical Abstract, and the 1987 Digest of Education Statistics. Alternative sources for United States data are used because the United States is no longer a member of UNESCO, and that organization no longer updates several of its statistics on the United States' educational system. These alternative sources are generally more up-to-date, and have been assumed to be more accurate, than the data in the UNESCO Yearbook. However, use of these alternative data sources produces further difficulties for comparing data.

In order to have more complete and updated international enrollment and expenditure statistics, a limited amount of data from other sources available at each country's embassy has also been used. In particular, most of the data on length of the school year have been obtained from these embassies. And, in order to analyze the level of science and math achievement for each nation, separate studies by the IEA have been used.

There are further limitations to the achievement data recorded by the IEA. First, and most important, is that these data are currently limited to only achievement in science and math. Therefore, these achievement results constitute only a portion of the skills schools are expected to teach (such as reading comprehension). Second, these test results are limited to only upper elementary through secondary students (age 10 through the final year of secondary education). This means there are no achievement results before

the upper elementary level or after the secondary level. Therefore, the possible influences on science and math achievement from early primary and postsecondary education are not available. Finally, like the UNESCO data, the IEA data are aggregate results. These results could mask trends in different achievement results for separate groups within each nations' population.

Conclusion

Because of the above limitations, some may question whether enrollment, expenditure, and achievement data should be used to compare the United States' educational system with systems from other countries. As mentioned, the use of these data exclusively may not take into consideration other important factors that influence educational achievement. These data may also mask other trends occurring among different groups in each nation's population. For the most part, these data cannot indicate which countries have "successful" educational systems, and which do not.

Additional, and currently unavailable, data might provide a more accurate picture of each nation's educational system. Secondary and postsecondary drop-out rates might give a better indication of how many students in each country are actually finishing their education. And a wider range of achievement data, in terms of subjects and skills, grade levels, and disaggregated results by sex and race, might provide a better estimation of how much and how efficiently students in each country are learning. Unfortunately, most of these other data are not available for most of the countries in this study.

The data from the UNESCO Yearbook, and from the other sources mentioned above, contain all the current and reliable major education policy-relevant data available on a wide scale. The Organization for Economic Cooperation and Development (OECD) is currently considering the development and publication of an "education indicators" report that would be regularly updated. While this proposal, if implemented, offers the possibility of providing a wider range of comparable education statistics than are now available for the OECD member nations,[7] such a report is not likely to be available in the near future.

The final major limitation of analyzing only expenditure, enrollment, and achievement data is that they do not measure the impact of other factors that influence education. Differences in each nation's culture, values and attitudes towards education and educational achievement undoubtedly have an effect on educational outcomes. How big an influence these other factors have is difficult to measure. But examining only expenditure and enrollment data does not consider them at all. A more complete comparison of U.S. and international educational system should address the effects of these other influences.

[7]The United States, Canada, Japan, and most Western European nations.

II. PARTICIPATION DATA

SECTION A: DATA TABLES AND GRAPHS

TABLE 1. Total Enrollments, All Levels of Education, 1985

Nation	Pre-primary enrollment	Primary enrollment	Secondary enrollment	Postsecondary enrollment	Total enrollment
Australia	161,974	1,530,463	1,271,543	206,077	3,170,057
Canada	422,085	2,254,887	2,250,941	1,294,194	6,222,107
China	14,796,900	33,701,800	50,926,400	1,778,608	201,203,708
Federal Republic of Germany	1,580,280	2,255,500	5,330,800	1,350,211	10,516,791
France	2,406,418	4,387,003	5,124,403	1,179,268	13,097,092
Italy	1,633,062	3,715,597	5,372,384	1,181,953	11,902,996
Japan	2,067,951	11,095,372	11,052,239	2,403,371	26,618,933
Mexico	2,381,412	15,124,160	6,549,105	1,207,779	25,262,456
Soviet Union	11,546,000	23,585,000	20,307,000	5,147,200	60,585,200
Sweden	324,880	612,704	624,835	220,947	1,783,366
United Kingdom	344,000	4,085,000	5,024,000	1,006,969	10,459,969
United States a/	2,335,000	31,218,000	13,775,000	12,242,000	59,570,000

a/ Source: Center for Education Statistics, Digest of Education Statistics, 1987. p. 9, 48. U.S. enrollments are for public and private primary and secondary schools in the fall of 1984.

Source (except where otherwise noted): United Nations Educational, Cultural, and Scientific Organization, 1987 Statistical Yearbook. Chapter 3, p. 72-282.

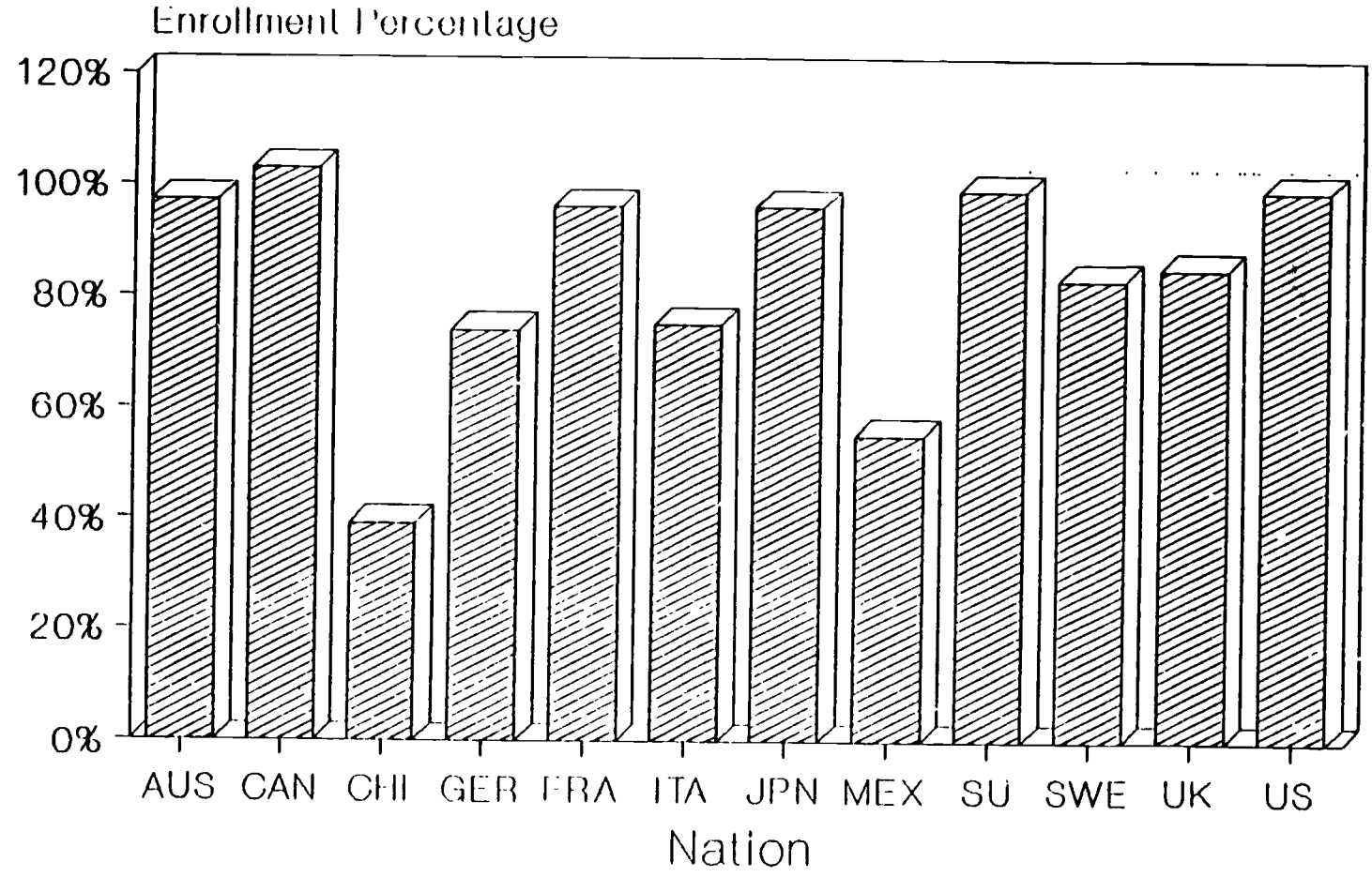
TABLE 2. Enrollment Rates For Secondary And Postsecondary Education, 1985

Nation	Secondary enrollment rates	Postsecondary enrollment rates a/	Postsecondary students per 100,000 inhabitants
Australia	97%	29%	2,464
Canada	103	55	5,090
China	39	2	168
Federal Republic of Germany	74	30	2,546
France	96	30	2,362
Italy	75	26	2,065
Japan	96	30	2,006
Mexico	55	16	1,529
Soviet Union	99	21	1,847
Sweden	83	37	2,650
United Kingdom	85	21	1,795
United States	99	57	5,145

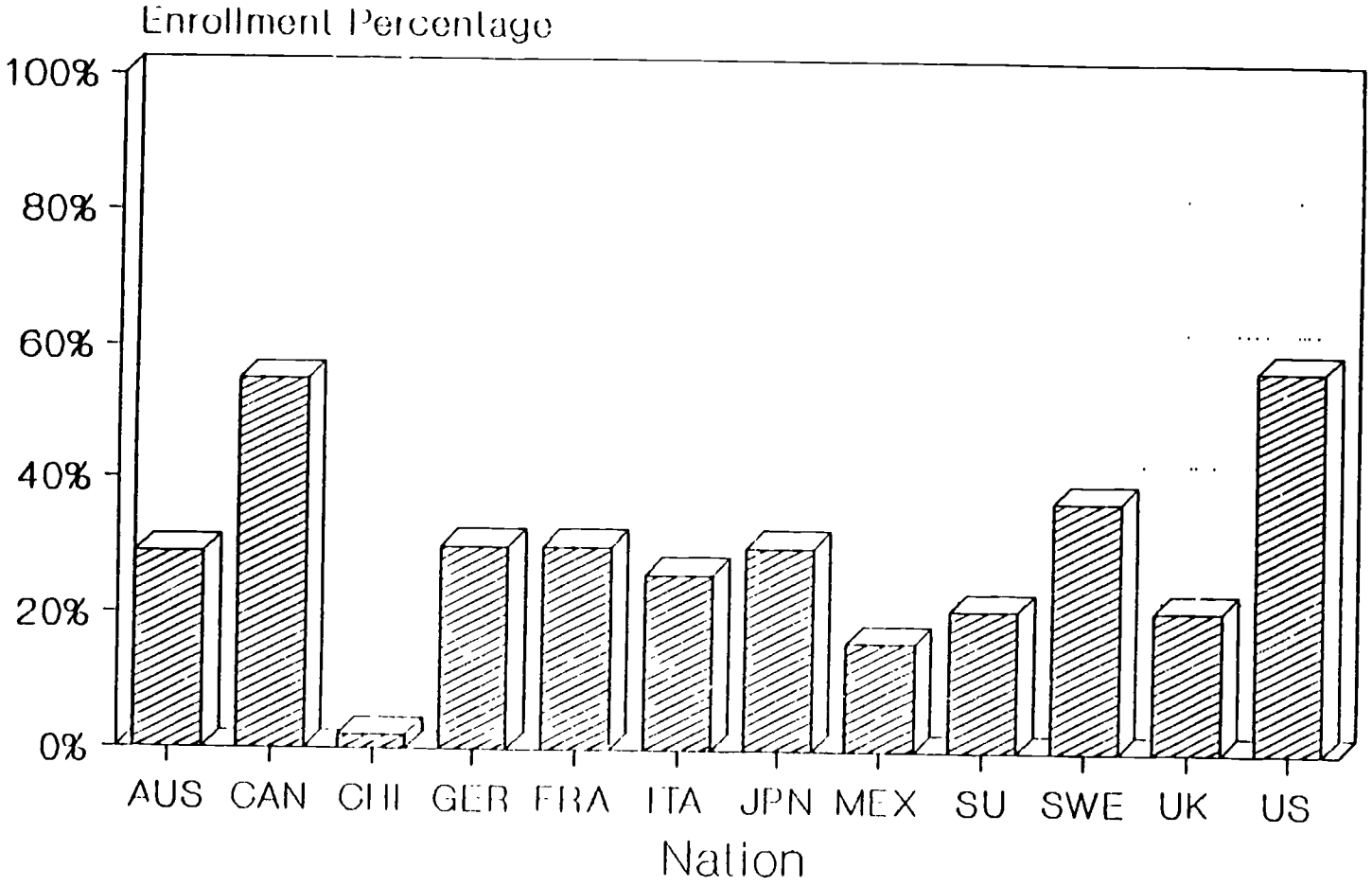
a/ All enrollment rates are "gross" enrollment rates--i.e., the number of students enrolled in the relevant level of education, divided by the total number of persons in the standard or traditional age range for that level of education. This may be contrasted with the concept of "net" enrollment rates, for which only the number of enrolled students in the standard or traditional age range would be included in the numerator of this ratio. In nations where a significant proportion of the students in a level of education are of ages outside the "traditional" age range for that level of education, the result may be gross enrollment rates that exceed 100 percent, as is seen in the Canadian figure for the secondary enrollment rate.

Source: United Nations Educational, Scientific, and Cultural Organization, 1987 Statistical Yearbook, chapter 3, p. 20-71 and p. 239-246.

ENROLLMENT RATES
Secondary Education, 1985



ENROLLMENT RATES
Postsecondary Education, 1985



POSTSECONDARY ENROLLMENT

Per 100,000 Inhabitants, 1985

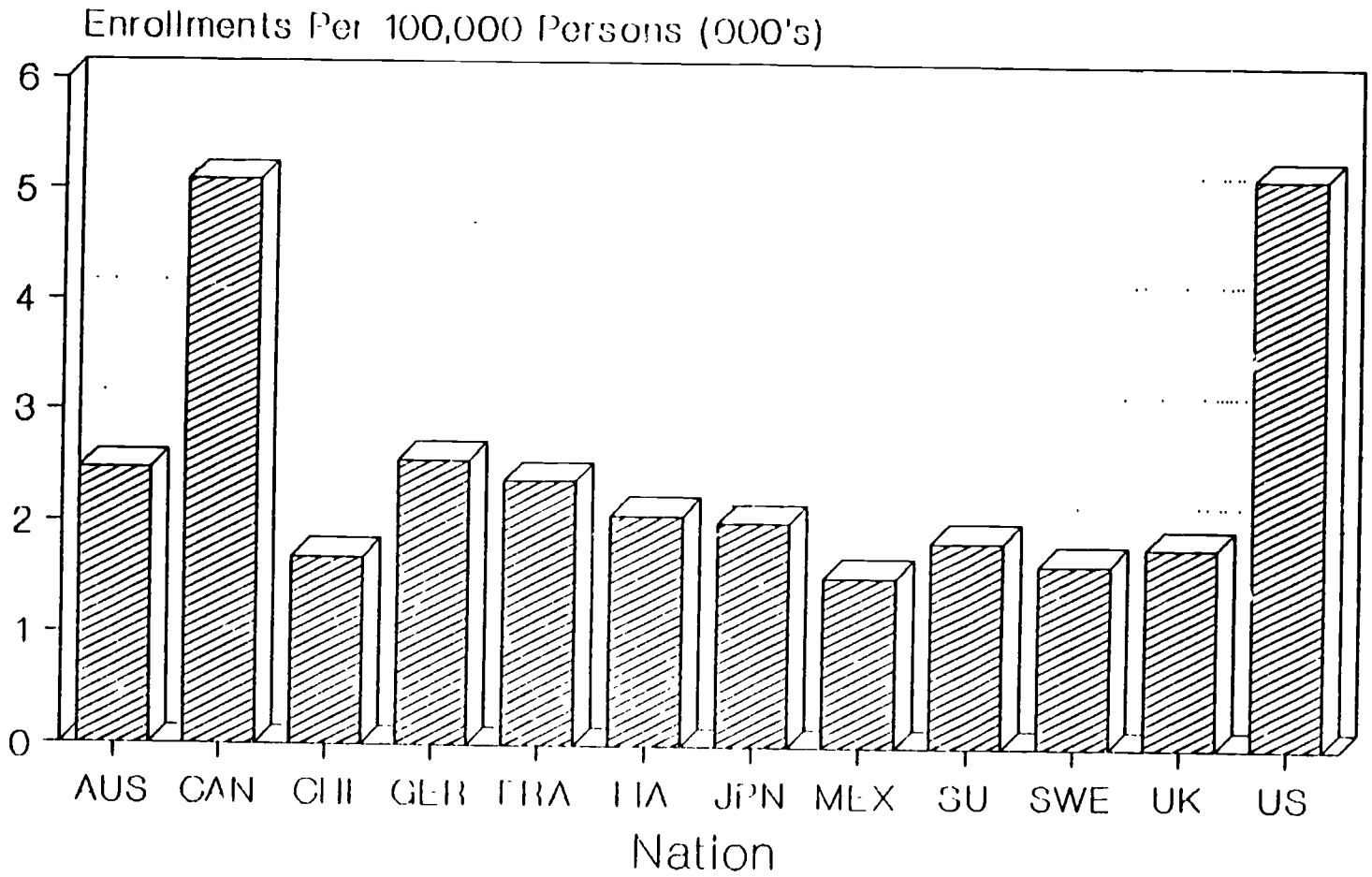


TABLE 3. Number of Teachers in Primary and Secondary Education, and Pupil-Teacher Ratio in Primary Education, 1985

Nation	Number of teachers			Pupil-teacher ratio primary education a/
	Primary	Secondary	Total	
Australia	107,396	105,955	213,351	18
Canada	299,025	130,551	429,576	17
China	5,376,800	2,996,400	8,373,200	25
Federal Republic of Germany	214,500	426,623	641,123	16
France	206,198	318,452	524,650	21
Italy	na b/	533,977	533,977	10
Japan	464,173	619,105	1,083,278	24
Mexico	449,760	380,774	830,534	34
Soviet Union	2,530,000	na	2,530,000	17
Sweden	na	51,466	51,466	12
United Kingdom	205,800	322,585	528,385	17 c/
United States d/	1,135,169	912,219	2,210,425 e/	18 f/

a/ NOTE: Secondary education pupil-teacher ratio data are not available.

b/ Throughout this and the following tables, "na" means not available.

c/ Source: Educational Statistics for the United Kingdom, 1987. p. 17.

d/ Source: Center for Educational Statistics, Digest of Educational Statistics, 1987. p. 58.

e/ According to the Digest of Educational Statistics, 1987, the U.S. has 163,037 "unclassified" teachers.

f/ Ibid., p. 59

Source (except where otherwise noted): United Nations Educational, Cultural, and Scientific Organization, 1987 Statistical Yearbook, chapter 3. p. 86-200.

PUPIL-TEACHER RATIO

Primary Education, 1985

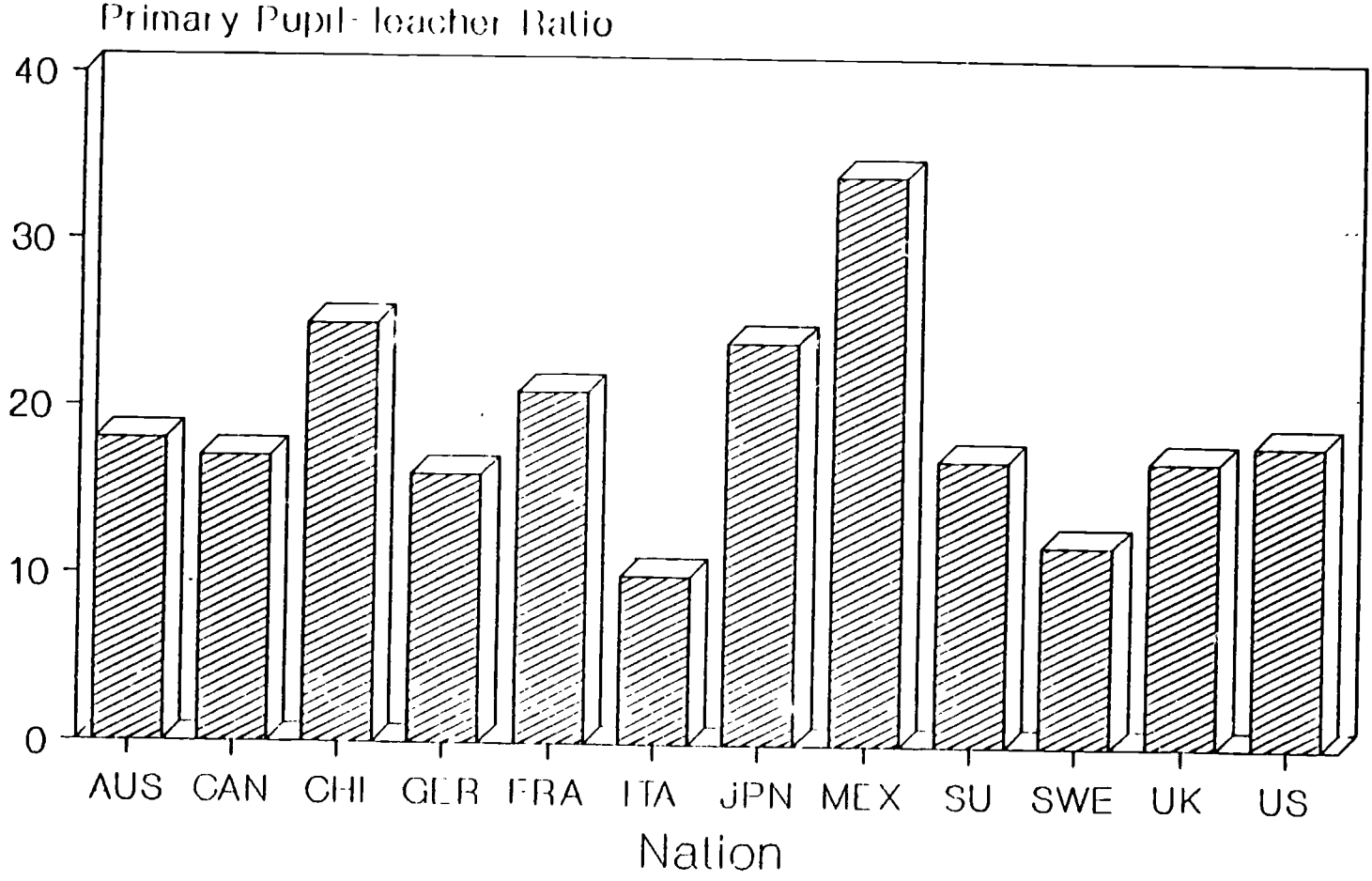


TABLE 4. Enrollments In Postsecondary Education, By Field Of Study, 1985

Nation	Education	Arts and humanities	Law	Social sciences	Business administration	Natural sciences and mathematics
Australia	71,586	65,938	10,079	24,478	66,188	na
Canada	71,856	89,976	12,294	108,346	167,072	84,240
China	425,931	146,886	38,825	na	151,617	140,905
Federal Republic of Germany	93,971	248,954	86,499	287,334	31,823	178,550
France	na	291,151	136,034	93,947	na	148,428
Italy	33,648	134,685	79,073	86,748	4,388	59,745
Japan	228,685	426,375	na	760,132	na	65,583
Mexico	156,168	23,534	112,295	81,278	218,150	61,178
Soviet Union	1,519,500	48,300	383,200	na	na	na
Sweden	27,507	31,997	9,482	15,868	22,934	18,476
United Kingdom	75,516	129,058	28,008	64,846	139,776	126,761
United States a/	732,000	852,000	252,000	763,000	2,586,000	763,000

a/ Source: Center for Education Statistics, Digest of Education Statistics, 1987. p. 148. Data are for 1984.

TABLE 4. Enrollments in Postsecondary Education, by Field of Study, 1985--Continued

Nation	Health sciences	Engi-neering	Agricul-ture	Other	Total	Percentage in natural science or mathematics b/
Australia	21,285	28,709	8,100	12,493	308,856	16%
Canada	79,421	88,457	5,890	266,959	974,511	26
China	166,008	466,276	110,028	132,132	1,778,608	43
Federal Republic of Germany	219,745	258,588	45,251	99,496	1,550,211	42
France	187,780	8,973	na	65,630	931,943	37
Italy	89,085	5,304	9,870	32,049	534,595	29
Japan	147,601	406,145	63,583	305,267	2,403,371	26
Mexico	148,709	209,357	97,639	90,812	1,199,120	35
Soviet Union	376,000	2,287,400	532,800	na	5,147,200	52
Sweden	27,470	62,952	2,646	14,110	233,442	47
United Kingdom	158,014	159,038	8,717	110,435	1,000,169	44
United States c/	1,305,000	1,229,000	259,000	2,234,902	10,975,902	30

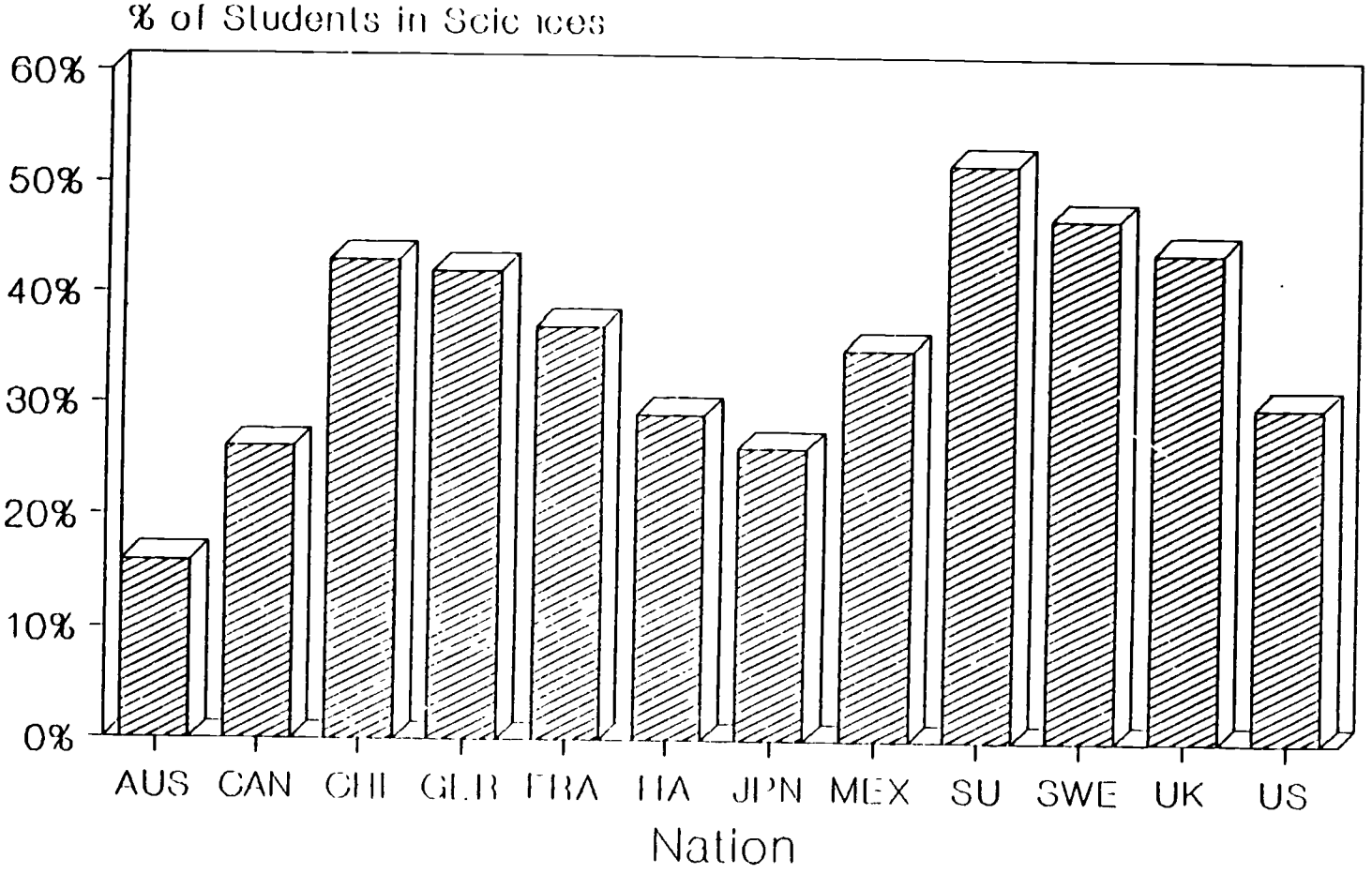
b/ Enrollments in natural science or mathematics include students in the categories of "natural sciences and mathematics," "health sciences," and "engineering."

c/ Source: Center for Education Statistics, Digest of Education Statistics, 1987. p. 148. Data are for 1984.

Source (except where otherwise noted): United Nations Educational, Scientific, and Cultural Organization, 1987 Statistical Yearbook, chapter 3. p. 342-387.

SCIENCE ENROLLMENT

% of Postsecondary Students, 1985



See table for details

TABLE 5. Graduates of Postsecondary Educational Institutions, by Field of Study, 1985

Nation	Education	Arts and humanities	Law	Social sciences	Business administration	Natural sciences and mathematics
Australia	21,629	12,858	2,066	2,028	10,465	8,634
Canada	23,302	19,141	3,392	26,040	35,057	8,175
China	94,237	25,853	5,763	0	24,750	25,556
Federal Republic of Germany	28,735	9,491	7,024	27,543	7,257	11,328
France	14,500	63,821	36,606	17,903	23,545	39,603
Italy	2,730	11,975	8,417	9,141	927	8,633
Japan	66,985	114,736	na	166,123	na	14,538
Mexico	17,975	1,786	8,582	7,310	21,028	4,474
Soviet Union	na	na	na	na	na	na
Sweden	na	na	na	na	na	na
United Kingdom	21,443	32,946	7,934	20,413	41,862	14,679
United States	179,214	143,077	42,609	163,366	423,735	61,964

TABLE 5. Graduates of Postsecondary Educational Institutions, by Field of Study, 1985--continued

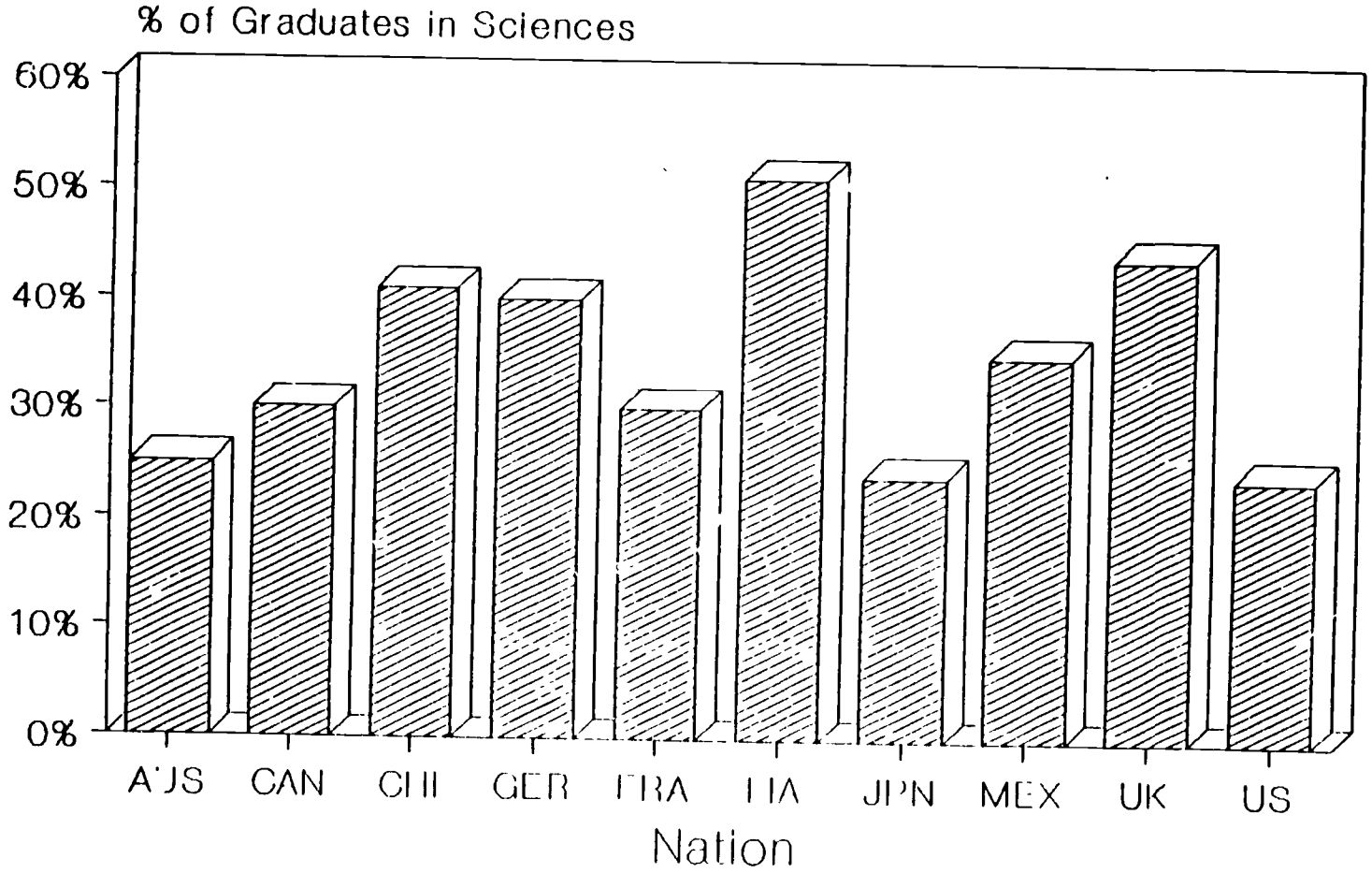
Nation	Agriculture	Others	Total	Percentage in natural science and mathematics a/	Health sciences	Engineering
Australia	1,587	1,193	68,956	25%	4,50[illegible]	3,996
Canada	5,224	23,124	193,432	30	19,301	20,676
China	21,744	26,188	335,210	41	29,871	81,248
Federal Republic of Germany	4,726	50,087	226,307	40	58,946	[illegible],170
France	3,364	28,792	269,841	30	26,705	15,002
Italy	3,182	7,794	90,645	51	31,701	6,145
Japan	16,138	73,909	576,487	24	29,091	94,967
Mexico	9,5[illegible]	7,657	113,10[illegible]	35	19,041	15,711
Soviet Union	na	na	na	na	na	na
Sweden	na	na	na	na	na	na
United Kingdom	2,831	16,188	258,599	44	57,074	43,229
United States	29,832	402,641	1,830,258	24	182,519	101,301

a/ Graduates in natural science and mathematics are defined as including those in the fields of "natural sciences and mathematics," "health sciences," and "engineering."

Source: United Nations Educational, Scientific, and Cultural Organization, 1987 Statistical Yearbook, chapter 3. p. 388-437.

SCIENCE GRADUATES

% of Postsecondary Graduates, 1985



See table for details

TABLE 6. Postsecondary Students Enrolled in "Universities" a/ Versus Other Types of Postsecondary Institutions, 1985

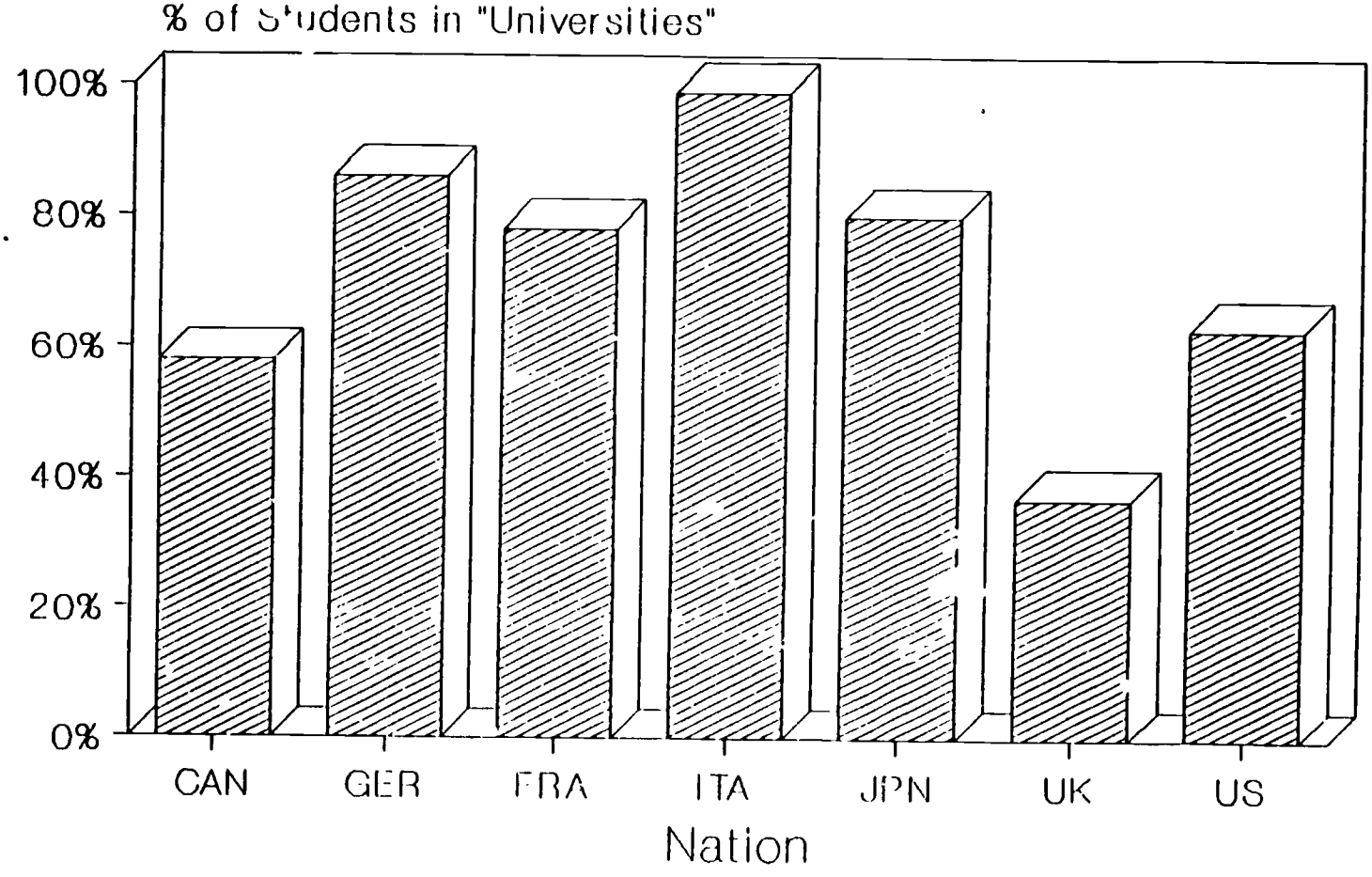
Nation	"Universities"	Enrollment in other postsecondary institutions	Total	Percentage in "universities"
Australia	209,077	na	209,077	na
Canada	752,276	541,918	1,294,194	58%
China	1,778,608	na	1,778,608	na
Federal Republic of Germany	1,336,395	213,816	1,550,211	86
France	923,547	255,721	1,179,268	78
Italy	1,173,910	8,043	1,181,953	99
Japan	1,938,939	464,432	2,403,371	80
Mexico	1,199,120	na	1,199,120	na
Soviet Union	5,147,200	na	5,147,200	na
Sweden	na	na	na	na
United Kingdom b/	345,760	583,873	929,633	37
United States	7,715,978	4,531,077	12,247,055	63

a/ "Universities" are defined as including institutions of higher education that confer postsecondary degrees at the baccalaureate level or higher--i.e., in the United States, all 4-year colleges or universities, including graduate programs.

b/ Note: Data for the United Kingdom include enrollments in the Open University.

Source: United Nations Educational, Scientific, and Cultural Organization, 1987 Statistical Yearbook, chapter 3. p. 247-283.

% IN "UNIVERSITIES"
Postsecondary Students, 1985



See table for details

TABLE 7. Average Length of the School Year for Elementary and Secondary Education, in Days

Nation	Average length of the school year, in days
Australia	na a/
Canada b/	191
China	na c/
Federal Republic of Germany d/	160-170
France	185
Italy	210-215 e/
Japan	243

a/ According to the Australian Embassy, the current public primary and secondary school year lasts from Feb. 1 to Dec. 16. However, a specific count of the number of school days within this period, excluding holidays, could not be obtained.

b/ Average of school year lengths for the Provinces of British Columbia and Ontario.

c/ According to the Chinese Embassy, the current primary and secondary school year lasts from Sept. 1 to "late July." However, a specific count of the number of school days within this period, excluding holidays, could not be obtained.

d/ According to the Embassy of the Federal Republic of Germany, the range of school year lengths for the various Lander ("States") is 160-170 days per school year.

e/ Source: Italian Embassy. The count includes Saturdays.

TABLE 7. Average Length of the School Year for Elementary and Secondary Education, in Days--Continued

Nations	Average length of the school year, in days
Mexico	180 f/
Soviet Union	na g/
Sweden	180
United Kingdom h/	196
United States	180

f/ Source: Mexican Embassy.

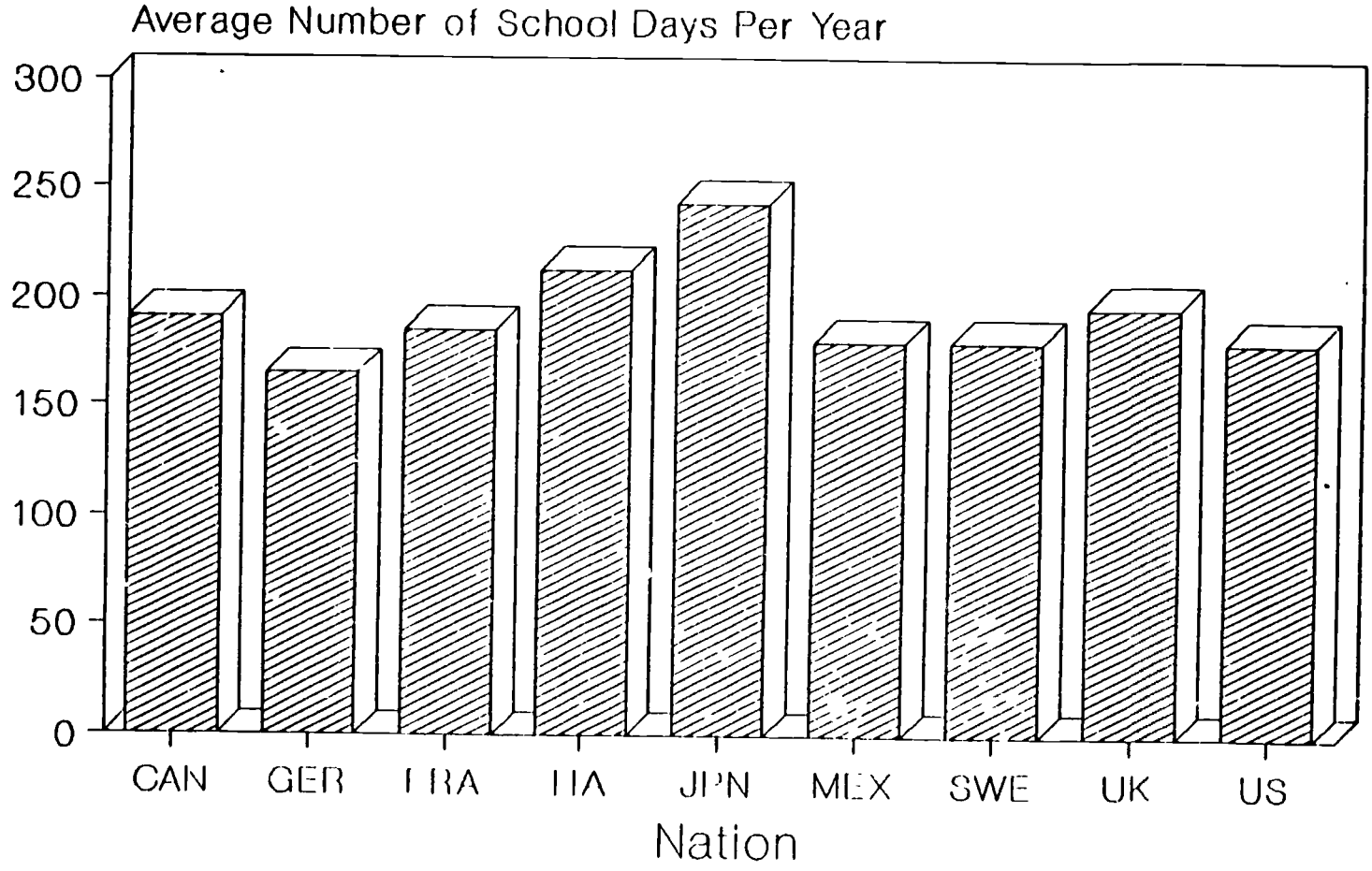
g/ The current primary and secondary school year in the Soviet Union lasts from Sept. 1 to May 30. However, a specific count of the number of school days within this period, excluding holidays, could not be obtained.

h/ Average of school year lengths for England/Wales and for Scotland.

Source (except where otherwise noted): International Association for the Evaluation of Educational Achievement, The Underachieving Curriculum: Assessing U.S. School Mathematics From An International Perspective, 1987, p. 52.

LENGTH OF SCHOOL YEAR

Public Primary/Secondary Schools



See table footnotes for details

SECTION B: DISCUSSION AND ANALYSIS

Discussion of Findings

The standing of the United States is relatively high on general measures of educational participation **(tables 1 and 2)**. The "gross" enrollment rate[8] of the United States is among the highest in the world at the secondary level, and is the highest among the 12 nations at the postsecondary level. On a second relative measure of postsecondary education participation, students per 100,000 persons in the total population, the United States' ranking is also highest for these 12 nations.

Regarding these data, it should be emphasized that they consider only enrollments, not program completion. Thus, secondary or postsecondary education drop-out rates are not directly taken into account, and we cannot estimate the relative percentage of the United States' versus other nations' secondary or postsecondary students who actually complete their diploma or degree programs.[9] In addition, since only the number of persons in the "standard" age range is considered in calculating enrollment rates, these rates are overstated in nations, such as the United States, where a substantial proportion of students are older than the "traditional" students. Nevertheless, the rate of postsecondary enrollment is highest for the United States even on the measure of students per 100,000 persons in the total population, a statistic that is not affected by this bias.

Teachers

Table 3 displays the number of teachers in primary and secondary schools, plus the primary-level pupil-teacher ratio (average number of pupils per teacher).[10] It is often assumed that, if all other relevant factors are held

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[8]I.e., the number of persons enrolled in a particular level of education divided by the total number of persons in the "standard" age range for that level of education (e.g., 18-21 year-olds for undergraduate postsecondary education in the United States).

[9]While data are available on both enrollments and graduates at the postsecondary level, it would be inappropriate to compare these figures, since many postsecondary students--especially in the United States--are in pre-baccalaureate or nondegree programs, while the graduate data include only those receiving baccalaureate or higher degrees.

[10]We have provided data only on the primary, as opposed to primary plus secondary, pupil-teacher ratio mainly because most class-size debate and research is focused on primary education. Class sizes are also more difficult to measure for secondary education because of departmentalization of courses and teachers.

constant, a lower pupil-teacher ratio leads to better educational results. However, most available research supports this assumption only in cases where the pupil-teacher ratio is quite low--e.g., approximately 15 or fewer pupils per teacher.[11] The primary pupil-teacher ratio for the United States, 18 pupils per teacher, is slightly lower than the average for the 12 nations, which is 19.[12] However, if the relatively less developed nations of China and Mexico are excluded, the primary school pupil-teacher ratio for the United States is equal to, or higher than, that for all other nations in this report except Japan, which has an average of 24 primary pupils per teacher.

Postsecondary Enrollments and Graduates

Postsecondary enrollments and graduates, by major field of study, are displayed in **tables 4 and 5**. The fields of specialization have been grouped into general categories, and the percentage of enrollments/graduates in the fields of natural science or mathematics is calculated.[13] The natural science and mathematics subject fields are emphasized because they are frequently the focus of attention in analyses, as well as congressional and public debate, of the impact of education on economic productivity and competitiveness, which are currently major concerns of the Congress. The United States ranks slightly below average--8th--for the 12 nations in the percentage of postsecondary students enrolled in the natural sciences or mathematics, and is tied for the lowest percentage among 10 nations in graduates in these fields. The nations with the highest percentage of enrollments in the natural sciences and mathematics are the Soviet Union, Sweden, and the United Kingdom, while the percentage of graduates in these fields is highest in Italy, the United Kingdom, and China (comparable counts of graduates by field are not available for the Soviet Union and Sweden). Interestingly, the nation tied with the United States in the percentage of postsecondary graduates in the natural sciences or mathematics is Japan.

Additional data on postsecondary education participation is found in **table 6**, which shows the number and percentage of postsecondary students who attend "universities" versus other types of postsecondary institutions. "Universities" are defined as including colleges, universities, or other postsecondary institutions that confer degrees at the baccalaureate or higher

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[11]See, for example, the Mar. 1988 report by the Office of Educational Research and Improvement, U.S. Department of Education, Class Size and Public Policy: Politics and Panaceas, by Tommy M. Tomlinson.

[12]This average pupil-teacher ratio for the 12 nations is an unweighted average--i.e., each of the nations is counted as a single unit in calculating the average, as opposed to weighing each of the nations differently, according to its population size.

[13]This category is arbitrarily defined to include the major fields of the natural sciences (biology, chemistry, physics, etc.), mathematics, the health sciences (medicine, dentistry, etc.), and engineering.

(master, doctoral, etc.) level, as opposed to other postsecondary institutions, such as community colleges or proprietary vocational schools in the United States. These data are available only for seven of the nations included in this report. Among these, the proportion of postsecondary enrollments in "universities" is highest in Italy, the Federal Republic of Germany, and Japan, and is lowest in the United Kingdom (where nonuniversity enrollments include those in the Open University), Canada, and the United States.

Length of School Year

The final statistic included in the Participation section of this report is the average length of the public primary and secondary school year, in days **(table 7)**. These data are not available for three of the nations, while for two others only a range of number of days is available.[14] According to these data, which were gathered from a variety of sources, the average length of the public school year is shortest (180 days or less) in the Federal Republic of Germany, Mexico, Sweden, and the United States, and is longest (195 days or more) in Japan, Italy, and the United Kingdom. The length of the Japanese school year is by far the greatest at 243 days; however, this figure, as well as that for Italy, includes Saturdays, on which the school day is shorter than on weekdays.

Analysis

Clearly, when attention is focused on aggregate enrollment rates--as opposed to program/degree completion rates, or enrollment/graduation in specific subject areas such as science and mathematics--participation rates are comparatively high for the United States. In contrast, relatively low proportions of American postsecondary students specialize in the natural sciences or mathematics, which are the fields generally considered to be most directly relevant to economic competitiveness.

In addition to relatively low enrollment in science and mathematics at the postsecondary level, American primary and secondary students attend school fewer days per year than do students in several other developed nations. Further, American postsecondary students are relatively more likely than those of the other nations considered to attend institutions that do not offer bachelor's or higher degrees, such as community colleges, proprietary and other vocational schools.

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[14]NOTE: Where only a range of number of days in the school year is available, the graph entry is based upon an average of the maximum and minimum value of the range.

III. EXPENDITURE DATA

SECTION A: DATA TABLES AND GRAPHS

TABLE 8. Total Current Expenditures for Education, by Level, 1985 in Thousands of U.S. Dollars

Nation	Pre-primary, primary, and secondary	Post-secondary	Undistributed a/	Other b/	Total	Percentage for primary and secondary education
Australia c/	$ 6,114,417	$ 2,831,637	$ 345,557	$ 307,161	$ 9,598,772	62%
Canada	14,060,013	6,344,692	1,702,234	0	22,106,939	64
China	3,931,291	1,366,861	595,650	376,200	6,270,002	62
Federal Republic of Germany d/	24,621,709	1,002,000	na	3,337,000	28,960,709	80
France e/	21,005,475	3,732,990	3,318,213	1,629,480	29,686,158	62

a/ The "undistributed" category includes amounts expended for multiple levels of education, plus special, adult, or other types of education that cannot be specified by level.

b/ The "other" category includes expenditures for administrative expenses plus unspecified educational expenditures.

c/ Data are for 1984.

d/ Calculated from data compiled by the Federal Republic of Germany, Ministry of Education and Science, Basic and Structural Data, 1986/87. p. 104.

e/ Data are for 1982.

TABLE 8. Total Current Expenditures for Education, by Level, 1985 in Thousands of U.S. Dollars--Continued

Nation	Pre-primary, primary, and secondary	Post-secondary	Undistributed a/	Other b/	Total	Percentage for primary and secondary education
Italy f/	$ 11,867,000	$ 1,865,000	na	$4,708,000	$18,440,000	59%
Japan g/	53,432,000	15,837,000	na	2,140,000	71,409,000	75
Mexico	1,909,000	1,164,000	$ 255,000	654,000	3,982,000	43
Soviet Union	32,107,784	5,755,169	5,452,265	na	43,315,218	50
Sweden	4,567,124	878,551	784,660	476,161	6,706,496	68
United Kingdom	13,907,838	4,555,184	2,894,883	na	21,357,905	62
United States h/	137,350,722	92,472,694	na	na	229,823,416	62

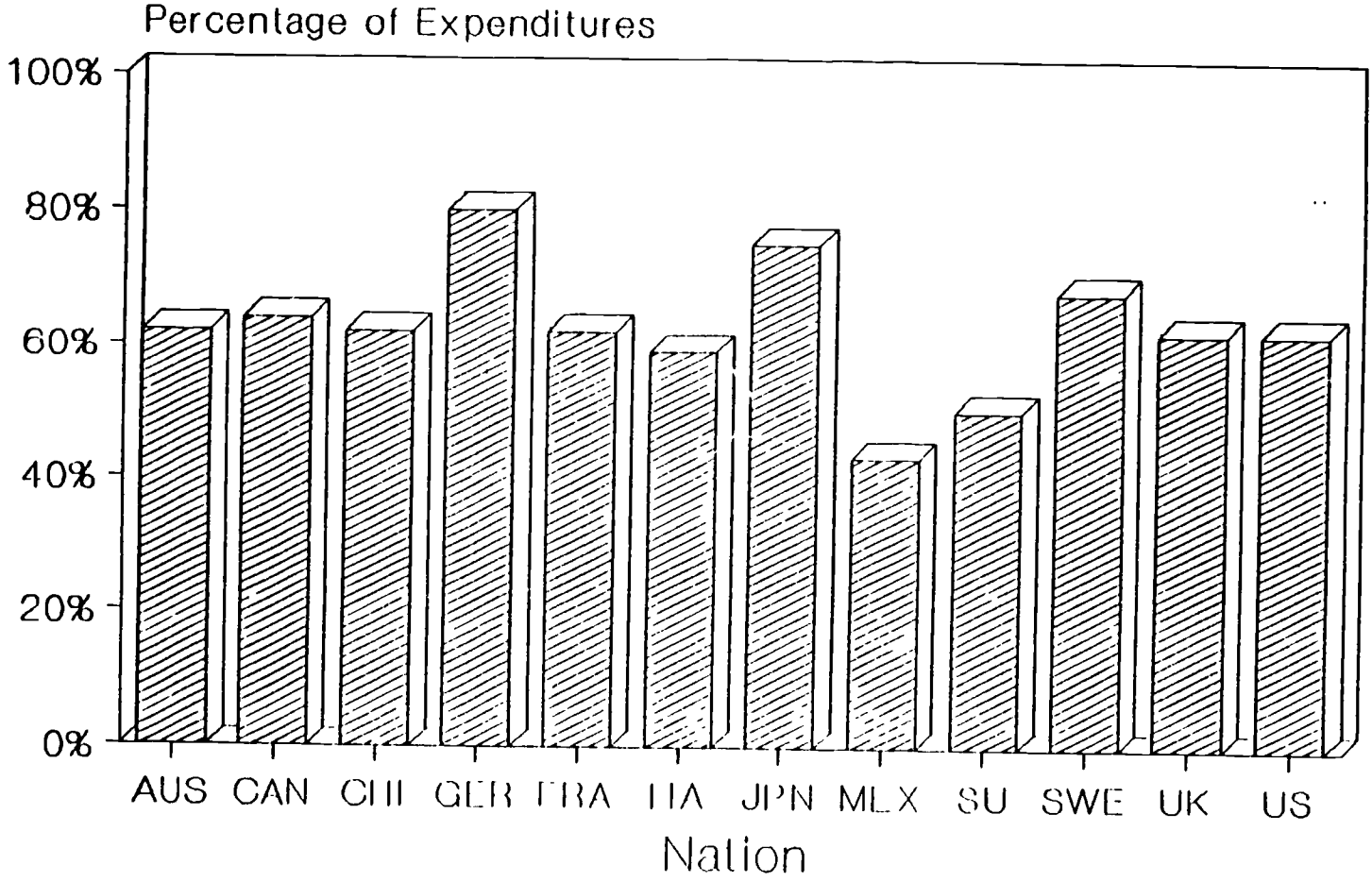
f/ Data are for 1983.

g/ Calculated from data for 1983 compiled by the Japanese Ministry of Education, Science and Culture, Education in Japan: A Brief Outline, 1986. p. 21.

h/ Source: Center for Education Statistics, Digest of Education Statistics, 1987. p. 107, 228.

Source (except where otherwise noted): United Nations Educational, Scientific, and Cultural Organization, 198/ Statistical Yearbook, chapter 4. p. 42-52. Data do not include capital expenditures.

% EDUCATION EXPENDITURES
For Primary/Secondary Education



Expenditure years vary--see table

TABLE 9. Percentage Of Gross National Product and of Government Expenditures for Education at All Levels, 1985

Nation	Percentage of gross national product for education	Percentage of government expenditures for education
Australia a/	6.5%	13.2%
Canada	7.2	12.7
China	2.9	9.5 b/
Federal Republic of Germany	4.6	9.2
France c/	5.8	na
Italy d/	5.7	9.6
Japan e/	5.6	18.7
Mexico	2.6	na

a/ Data are for 1984.

b/ Source: Conversation with education liaison Embassy of the People's Republic of China.

c/ Data are for 1982.

d/ Data are for 1983.

e/ Ibid.

TABLE 9. Percentage Of Gross National Product and of Government Expenditures for Education at All Levels, 1985--Continued

Nation	Percentage of gross national product for education	Percentage of government expenditures for education
Soviet Union	na	na
Sweden	7.7	12.6
United Kingdom f/	5.2	11.3
United States	6.6 g/	13.6 h/

f/ Data are for 1984.

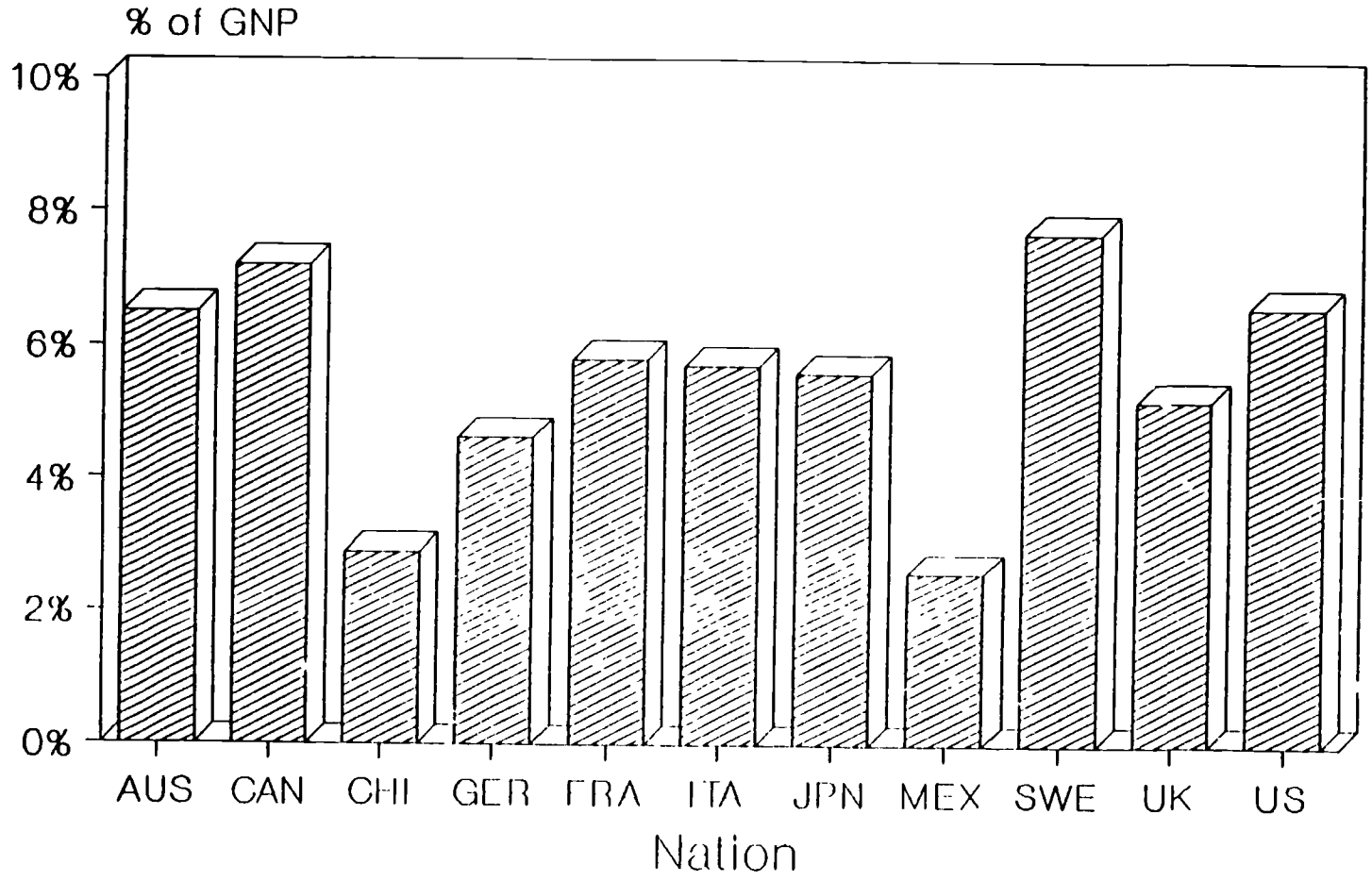
g/ Source: Calculated from data compiled in the Digest of Education Statistics, 1987. p. 24, and the Statistical Abstract of the United States, 1988. p. 258, 410. Total U.S. educational expenditure are divided by estimated Gross National Product for 1985.

h/ Source: Calculated from data compiled in the 1988 Statistical Abstract of the United States. p. 254. Includes expenditures by all levels of government: Federal, State, and local.

Source (except where otherwise noted): United Nations Educational, Scientific, and Cultural Organization, 1987 Statistical Yearbook, chapter 4. p. 5-21. Data include capital expenditures.

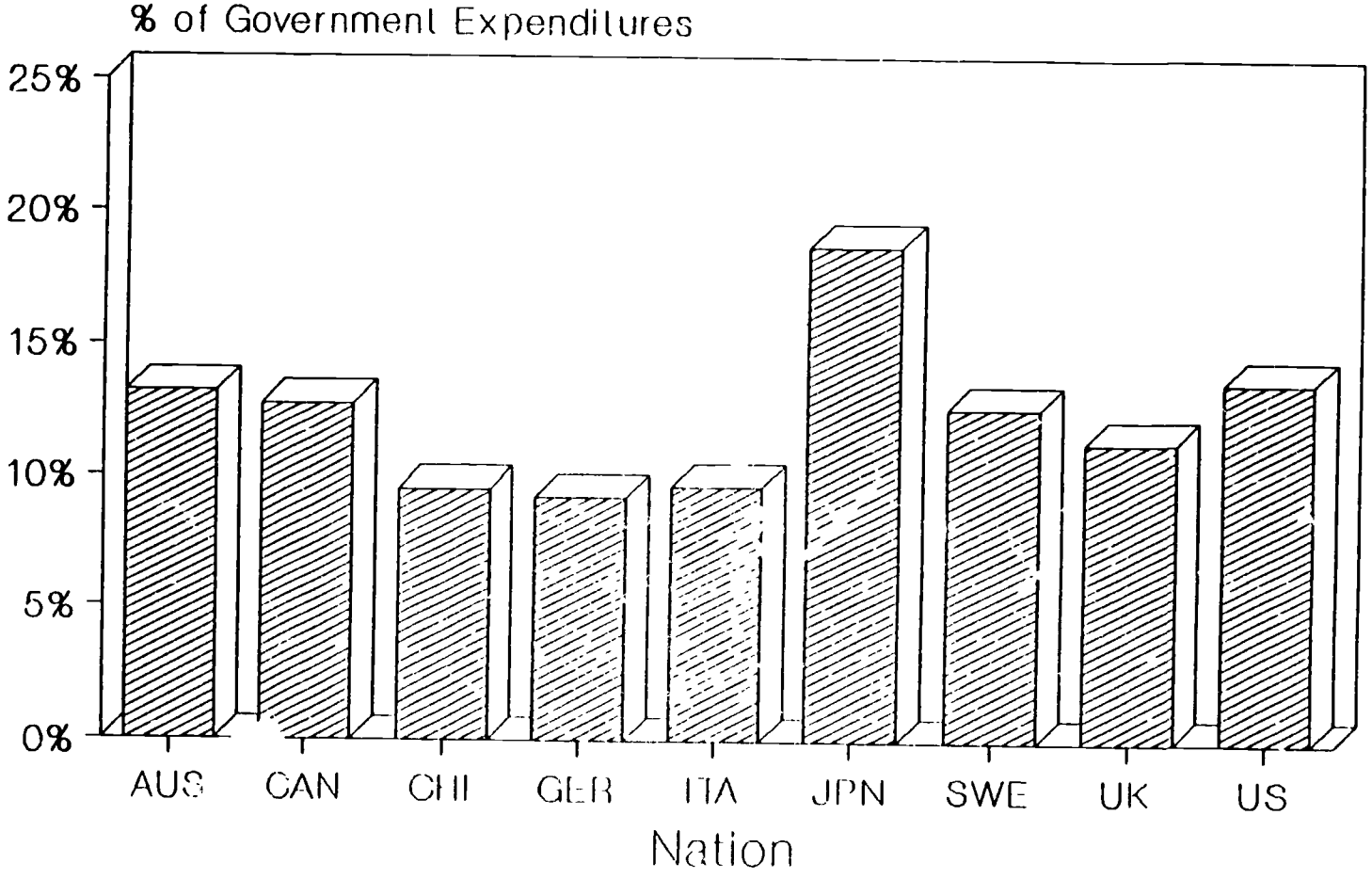
% OF GNP FOR EDUCATION

All Levels



Expenditure years vary--see table

% GOVT. EXPENDS. FOR ED.
All Levels



Expenditure years vary--see table

TABLE 10. Average Expenditure Per Pupil for Public Primary and Secondary Education, 1985, in U.S. Dollars

Nation	Average expenditure per pupil for public primary and secondary education, 1985
Australia a/	$2,115
Canada	2,853
China	na
Federal Republic of Germany b/	2,956
France c/	1,947
Italy d/	1,155
Japan e/	2,427

a/ Data are for 1984.

b/ Source: Federal Republic of Germany, Ministry of Education and Science, Basic and Structural Data, 1986-87, p. 104.

c/ Data are for 1982.

d/ Data are for 1983.

e/ Data are for 1983, and are taken from the Japanese Ministry of Education, Science, and Culture, Education in Japan: A Brief Outline, 1986. p. 21.

Source (except where otherwise noted): Calculated from data compiled by the United Nations Educational, Cultural, and Scientific Organization and published in the 1987 Statistical Yearbook, chapter 4. p. 53-65. Current primary and secondary expenditures are divided by number of primary and secondary students. Capital expenditures are not included.

TABLE 10. Average Expenditure Per Pupil for Public Primary and Secondary Education, 1985, in U.S. Dollars--Continued

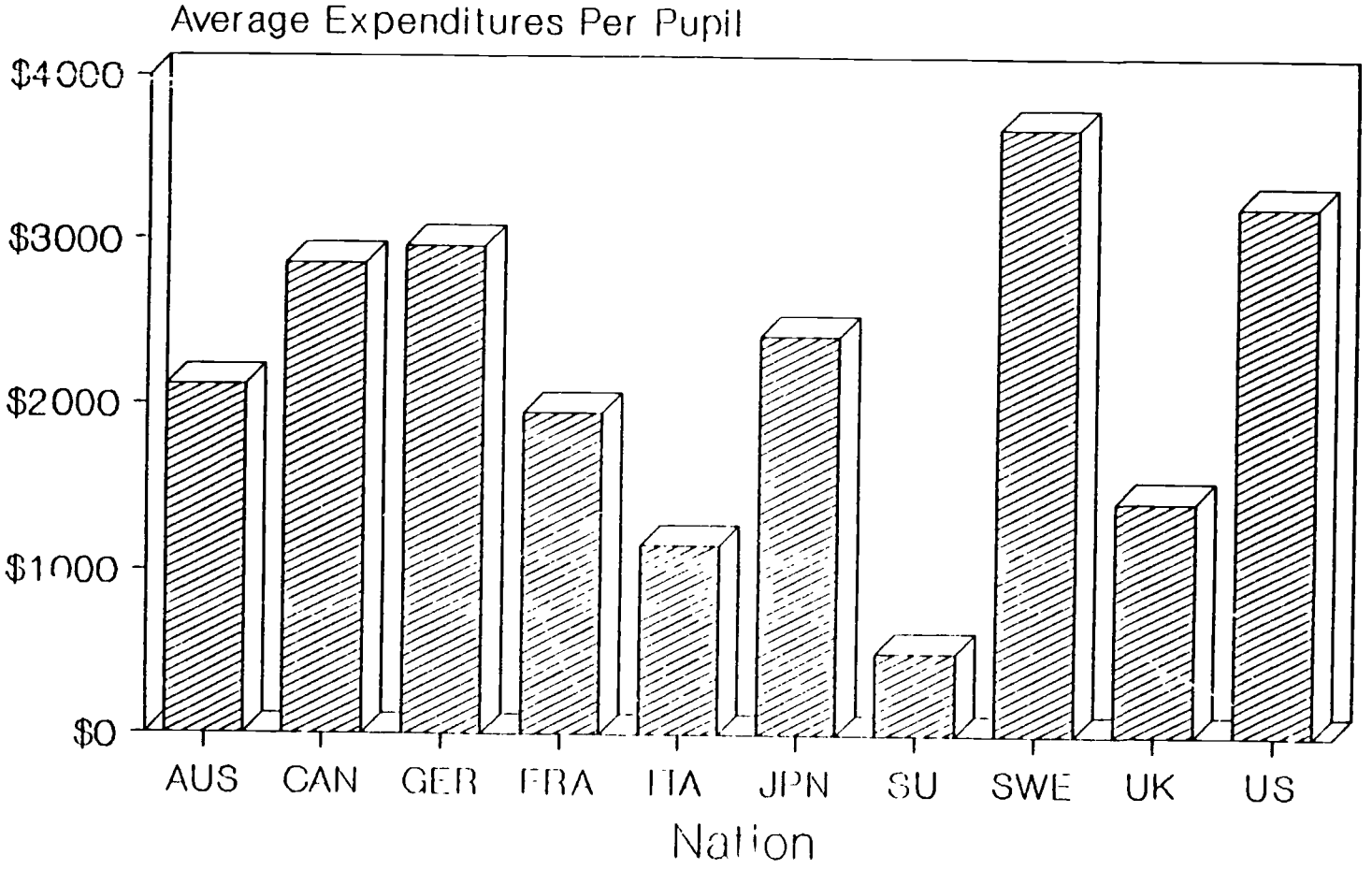
Nation	Average expenditure per pupil for public primary and secondary education, 1985
Mexico	na
Soviet Union	$ 498
Sweden	3,685
United Kingdom f/	1,428
United States g/	3,204

f/ Data are for 1984.

g/ Source: Calculated from data compiled by the Center for Education Statistics, Digest of Education Statistics, 1987. p. 42, 111. For the sake of comparability with the amounts for other nations, this figure was calculated on the basis of total current expenditures divided by total enrollment. However, for the United States, the more commonly used average expenditure per pupil figure is based on the number of pupils in average daily attendance (ADA). This amount is somewhat higher--$3,449 for the United States for 1984-85. ADA counts are not available for the other nations included in this report.

EXPENDITURES PER PUPIL

Primary/Secondary Education



Expenditure years vary--see table

TABLE 11. Estimated Average Share of Student Charges for Higher Education That Are Borne by Government (All Levels), 1985-86, for Undergraduate Students From Lower Income Families

Nation	Estimated average higher education charges	Estimated average government contribution	Government share
Australia	na	na	na
Canada	na	na	na
China	(a/)	(a/)	(a/)
Federal Republic of Germany	$4,398	$2,565	58%
France	2,016	1,672	83
Italy	na	na	na
Japan	(b/)	(b/)	(b/)
Mexico	na	na	na
Soviet Union	(a/)	(a/)	(a/)
Sweden	4,217	1,885	38
United Kingdom	3,280	3,086	94
United States (public)	5,314	3,275	62
United States (private)	9,659	4,500	47

See footnotes on next page.

Footnotes:

a/ In China and the Soviet Union, no tuition is charged for higher education, and students receive stipends that are intended to pay for their full living costs. Therefore, the government share might be assumed to be 100 percent for these nations. However, precise estimates of student living costs, and information on whether student stipends are sufficient to pay those costs, are not available for China and the Soviet Union. Therefore, no data are included for these nations in this table.

b/ Although it was not included in the Johnstone study, data are available for Japan on the costs faced by students at Japanese higher educational institutions of various types, and the share of the costs that are met by government grants, parental contributions, and student earnings. However, these data are not comparable to those included in the table because they do not include estimates of the implicit "grant amount" of government-subsidized student loans. Student loans are widely utilized by Japanese students and are significantly subsidized by the government. Therefore, estimates of the government share of student costs for higher education in Japan that do not account for these loan subsidies are not comparable to the data included in the table.

For reference, but not comparison, purposes, it might be noted that the estimated average cost faced by Japanese students attending a university in 1982 was $4,956, while the average level of government direct grants to students was $309 (6 percent of total expenses). These figures include students from all family income levels attending both public and private universities. (Source: Japanese Ministry of Education, Science, and Culture, Statistical Abstract of Education, Science, and Culture, 1985. p. 138.)

NOTE: The estimated higher education charges are those faced by students and their families. Thus, the costs include estimated room, board, and other costs for all nations, but exclude costs of providing higher education that are not charged to students, such as general institutional grants to public colleges in the United States, or tuition/fees in the Federal Republic of Germany, France (in general), Sweden, or the United Kingdom, where tuition/fees are not charged.

The government share of higher education charges faced by families includes not only direct grants or scholarships, but also an estimate of the implicit "grant portion" of government-subsidized student loans.

Source: Johnstone, D. Bruce. Sharing the Costs of Higher Education. p. 148.

GOVERNMENT SHARE
Higher Education Costs/Lower Income

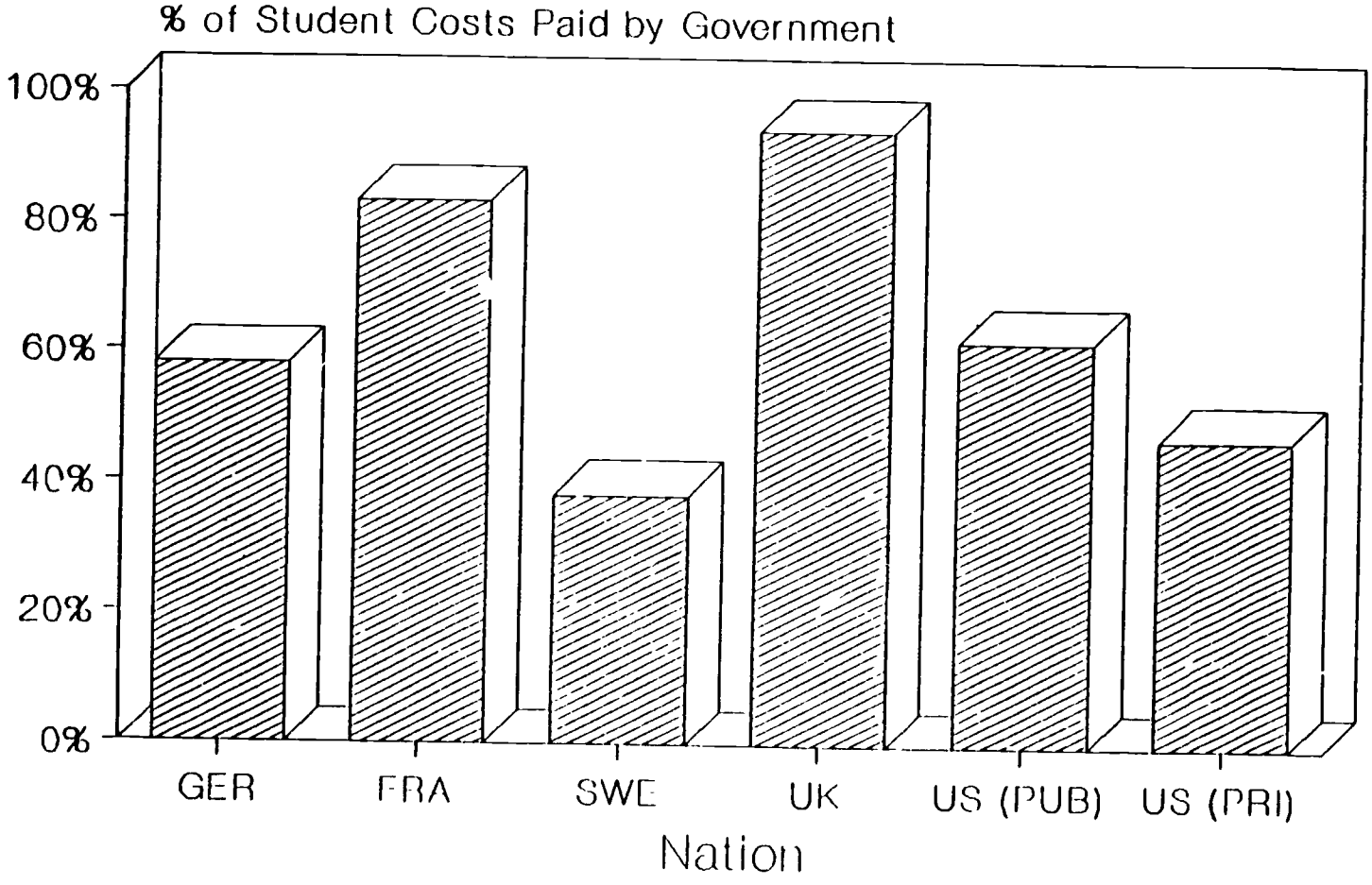


TABLE 12. Estimated Average Share of Student Charges for Higher Education That Are Borne by Government (All Levels), 1985-86, for Undergraduate Students From Middle Income Families

Nation	Estimated average higher education charges	Estimated average government contribution	Government share
Australia	na	na	na
Canada	na	na	na
China	(a/)	(a/)	(a/)
Federal Republic of Germany	$4,398	$624	14%
France	2,688	403	15
Italy	na	na	na
Japan	(b/)	(b/)	(b/)
Mexico	na	na	na
Soviet Union	(a/)	a/)	(a/)
Sweden	4,918	1,885	38
United Kingdom	3,280	937	29
United States (public)	5,314	575	11
United States (private)	9,659	1,825	19

See footnotes on next page.

Footnotes:

a/ In China and the Soviet Union, no tuition is charged for higher education, and students receive stipends that are intended to pay for their full living costs. Therefore, the government share might be assumed to be 100 percent for these nations. However, precise estimates of student living costs, and information on whether student stipends are sufficient to pay those costs, are not available for China and the Soviet Union. Therefore, no data are included for these nations in this table.

b/ Although it was not included in the Johnstone study, data are available for Japan on the costs faced by students at Japanese higher educational institutions of various types, and the share of the costs that are met by government grants, parental contributions, and student earnings. However, these data are not comparable to those included in the table because they do not include estimates of the implicit "grant amount" of government-subsidized student loans. Student loans are widely utilized by Japanese students and are significantly subsidized by the government. Therefore, estimates of the government share of student costs for higher education in Japan that do not account for these loan subsidies are not comparable to the data included in the table.

For reference, but not comparison, purposes, it might be noted that the estimated average cost faced by Japanese students attending a university in 1982 was $4,956, while the average level of government direct grants to students was $309 (6 percent of total expenses). These figures include students from all family income levels attending both public and private universities. (Source: Japanese Ministry of Education, Science, and Culture, Statistical Abstract of Education, Science, and Culture, 1985, p. 138.)

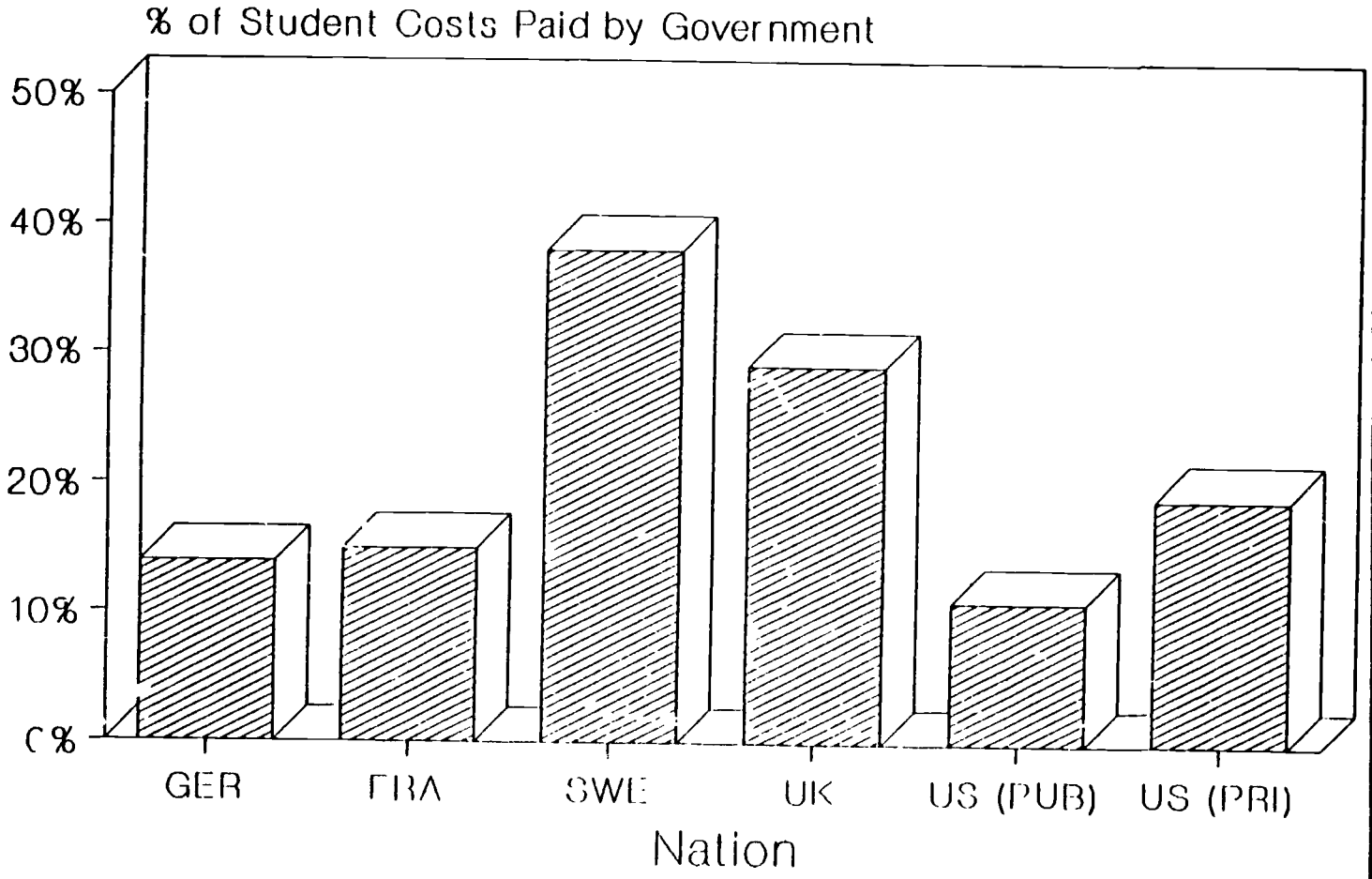
Note: The estimated higher education charges are those faced by students and their families. Thus, the costs include estimated room, board, and other costs for all nations, but exclude costs of providing higher education that are not charged to students, such as general institutional grants to public colleges in the United States, or tuition/fees in the Federal Republic of Germany, France (in general), Sweden, or the United Kingdom, where tuition/fees are not charged.

The government share of higher education charges faced by families includes not only direct grants or scholarships, but also an estimate of the implicit "grant portion" of government-subsidized student loans.

Source: Johnstone, D. Bruce. Sharing the Costs of Higher Education. p. 150.

GOVERNMENT SHARE

Higher Education Costs/Middle Income



SECTION B: DISCUSSION AND ANALYSIS

Discussion of Findings

Tables 8 through 12 of this report contain a variety of aggregate and relative statistics on educational expenditures for the 12 nations. On table 8 are displayed total education expenditures, by level of education, plus a calculation of the share of the total expended for primary and secondary--as opposed to postsecondary--education. These data are intended to include public expenditures for private educational institutions, where these exist. As shown in table 8 and the accompanying graph, the percentage of education expenditures that is devoted to primary and secondary education varies substantially, from high rates in the Federal Republic of Germany (80 percent) and Japan (75 percent), to relatively low rates in Mexico (43 percent), the Soviet Union (50 percent), and Italy (50 percent). The United States' figure, 62 percent, is the same as the unweighted average for these nations.

Share of GNP and of Government Expenditures

Table 9 compares total education expenditures with each nation's gross national product (GNP) and with total expenditures of all levels of government for all purposes. In the percentage of GNP devoted to education, the United States ranks above all other nations included in this report except Sweden and Canada, with Australia only 1/10th of a percentage point below the United States. In percentage of total government expenditures devoted to education, only one of these nations ranks above the United States--Japan. It might be noted that when the data in this table are combined with the figures on percentage of education expenditures devoted to primary and secondary education in table 8, the estimated percentage of GNP that is allocated specifically to primary and secondary education is an estimated 4.1 percent for the United States, but 4.2 percent for Japan. Thus, while total education expenditures represent a smaller share of the GNP in Japan than in the United States, expenditures for primary and secondary education are a slightly higher share of GNP in Japan than in the United States.

Average Expenditure Per Pupil

Table 10 displays estimates of the average expenditure per pupil for public primary and secondary education. The many limitations associated with such expenditure data, as discussed in the introductory section of this report, must be especially emphasized with respect to the data in this table. As with most other expenditure data included in this report, amounts for the United States are relatively high; only Sweden's average expenditure per pupil estimate is higher than that for the United States. However, the use of expenditure data from years other than 1985 for several of the nations likely overstates the gap in expenditures per pupil between the United States and several of the other nations. For example, the Japanese expenditure data are for 1983; the United States expenditures per enrolled pupil in school year 1982-83 were an estimated $2,730, an amount that is only 12 per cent above

the Japanese amount for 1983, rather than the 32 percent difference displayed in table 10.

Government Share of Student Charges for Higher Education

The final two tables in the Expenditure section display estimates of total charges to students for higher education, and of the share of those charges that are paid by government at any level. It should be emphasized that only charges to students are included; thus, estimated room and board costs are included, as are tuition and fees where these are charged, but government institutional subsidies that do not directly affect charges to students are not considered. Therefore, in the United States context, these charges include the total "cost of education" from the perspective of charges faced by a student and his or her family, but not institutional support, grants, or contracts, unless these are used directly and specifically to reduce student charges.[16] In nations where student loans are provided, guaranteed, and/or subsidized by the government, such as the United States, average loan amounts are divided into "true loan" and "implicit grant" portions, to account for the various interest subsidies and loan forgiveness schemes offered in these nations.[16]

These data were compiled by D. Bruce Johnstone for a report he prepared for the College Board (Sharing the Costs of Higher Education, 1986). Unfortunately, only five of the nations considered in this report were included

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[15]For example, public colleges in the United States typically receive general operating grants from the States in which they are located. Further, States and the Federal Government provide institutional grants to certain colleges--e.g., the grants to "developing" institutions authorized under Title III of the Higher Education Act. Such grants were not considered in the calculation of the government share of higher education charges in the Johnstone study.

It might also be noted that "opportunity costs" of postsecondary education are also excluded from consideration in these calculations. "Opportunity costs" are those resulting from income foregone by a student while attending an institution of postsecondary education--i.e., the amount that could be earned at a full-time job if the student were not in school.

[16]For example, if student loans are offered that must be fully repaid, but at an interest rate that is below market levels, with the government paying to lenders the difference between the market and student interest rates, then the value of the interest subsidy is considered to be an "implicit grant," and is included with the estimated average government share of student charges. It might be noted that in nations with a relatively low government share of student charges--Sweden, the United States, and the Federal Republic of Germany--government guaranteed and subsidized loans are available to help students pay their share of charges, although the subsidy portion of these loan programs has been taken into account in Johnstone's calculations.

in the Johnstone study--the Federal Republic of Germany, France, Sweden, the United Kingdom, and the United States. Nevertheless, we considered it appropriate to include information from this study because of its significance and uniqueness--we are aware of no other source of relatively current, comparable data of this type In a footnote to the table, data that are only partially comparable are provided for Japan, China, and the Soviet Union.

The government share of higher education charges is estimated for students in lower and middle income families. The income levels are measured in relation to each nation's economy and income distribution--e.g., the income level used to define a middle income family in France was an average income level for France, not an average for the United States or for the group of nations studied. Note also that on each table, two figures are provided for the United States, one for public and one for private institutions. These separate data are provided because of the large differences in average student charges and government subsidies between the two higher education sectors, and because the private sector of higher education is much larger in the United States than in other nations included in the Johnstone study.

The figures for students from lower income families are displayed in **table 11**. According to these data, the government share of student charges is highest in the United Kingdom and France, lowest in Sweden or in the United States for private educational institutions. It might be noted that in the nations with relatively low government share of student charges--Sweden, United States, and the Federal Republic of Germany--government guaranteed and subsidized loans are available to help students pay their share of charges, although the subsidy portion of these loan programs has been taken into account in Johnstone's calculations. **Table 12** displays similar data for students from middle income families. At this income level, the estimated government share of higher education charges is highest for students in Sweden and the United Kingdom, and lowest for students in the Federal Republic of Germany and France, plus students attending public institutions in the United States. In no nation is the estimated government share higher than 38 percent. It is of interest that the estimated government share of student charges is the same for students from lower and middle income families in Sweden, while the share is higher for United States students from middle-income families attending private (19 percent) than those attending public (11 percent) institutions of higher education.[17]

[17]This results at least partially from provisions in most U.S. student grant and loan programs that provide for marginally greater assistance to students attending higher cost institutions, if all other relevant factors are equal.

Analysis

As noted in previous sections of this report, special caution must be applied to interpretations of the expenditure data shown in these tables, especially those in which amounts are converted into U.S. dollars. There are fewer problems with the data expressed in terms relative to each nation's own currency--e.g., the share of GNP total government expenditures that is devoted to education.

The United States ranks relatively high in both the share of GNP and of total government expenditures that is devoted to education. However, as indicated previously, such calculations indicate nothing about the relative efficiency with which funds are used; nor are these figures adjusted for educational participation rates, which are relatively high for the United States, especially at the postsecondary level. Further, such nations as Japan and the Federal Republic of Germany, which devote less of their GNP to education in general than does the United States, place much higher emphasis on spending at the primary and secondary levels than does the United States, resulting in a higher percentage of GNP specifically for primary and secondary education for Japan. The Japanese also allocate a much greater share of government expenditures to education than does the United States.

Estimates of the average expenditures per pupil enrolled in primary and secondary education are also relatively high for the United States, although, as noted in the previous section, figures for many other nations are understated since they apply to earlier years than does the United States amount.

Finally, the data on the government share of charges for higher education faced by students and their families shows the United States to be at approximately the median level, among the small group of nations for which these estimates are available, for students from both lower and middle income families. The most important caution that must be applied to interpretation of these data is that they consider only the charges faced by students and their families, not the total costs of providing higher education. In most of the nations included in this report, the great majority of higher education institutions are public, and little or no tuition is charged to students. Thus, even though the heavy cost subsidies provided to public institutions in the United States are also not taken into account, it is probable that the government share of the total costs of providing higher education would be much higher for such nations as France, the Federal Republic of Germany, Sweden, and the United Kingdom than in the United States.

With regard to these data on the distribution of higher education charges, it should be emphasized that there is substantial, unresolved debate among education analysts in the United States over the "appropriate" balance of student/family versus government responsibility for meeting higher education costs. The debate is focused largely on whether the primary benefits of higher education are private benefits to the individuals directly receiving the education (e.g., through increased personal income), or are social benefits to the

nation at large (e.g., through higher tax payments by individuals with higher education, development of new products or production techniques at research universities, etc.). Many believe that if the benefits are mainly private, then students and their families should bear most of the costs, although through use of government-provided or -guaranteed loans, if necessary. Others argue that the benefits of higher education accrue primarily to society at large, and that government should pay most of the costs.

IV. ACHIEVEMENT DATA

SECTION A: DATA TABLES AND GRAPHS

TABLE 13. Mean (Average) Science Achievement Test Scores for Pupils in Population 1 (10-year olds) and Population 2 (14-year olds), 1983-86

Nation	Population 1 a/	Population 2 b/
Australia	12.9	17.8
Canada c/	13.7	18.6
China	na	na
Federal Republic of Germany	na	na
France	na	na
Italy	13.4	16.7
Japan	15.4	20.2
Mexico	na	na
Soviet Union	na	na
Sweden	14.7	18.4
United Kingdom d/	11.7	16.7
United States	13.2	16.5

a/ Maximum score = 24.0.

b/ Maximum score = 30.0.

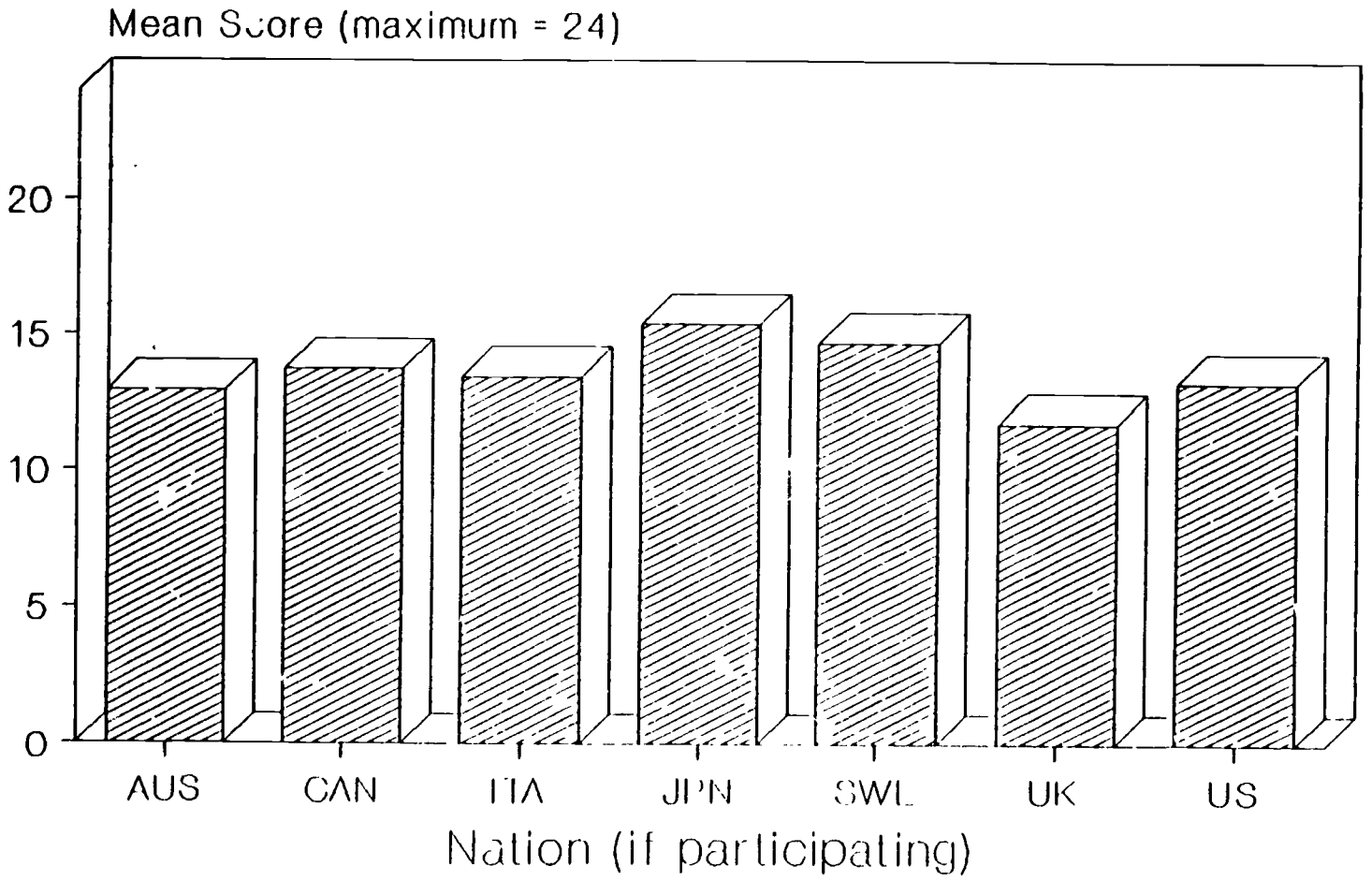
c/ Includes pupils in English-language Canadian schools only.

d/ Includes pupils in English schools only.

Based on tests developed by the International Association for the Evaluation of Educational Achievement, and administered during the period of 1983-86.

Source: International Association for the Evaluation of Educational Achievement, Science Achievement in Seventeen Countries, A Preliminary Report, 1988, p. 26 and 32.

SCIENCE ACHIEVEMENT
Population 1 (10-year olds)



SCIENCE ACHIEVEMENT

Population 2 (14-year-olds)

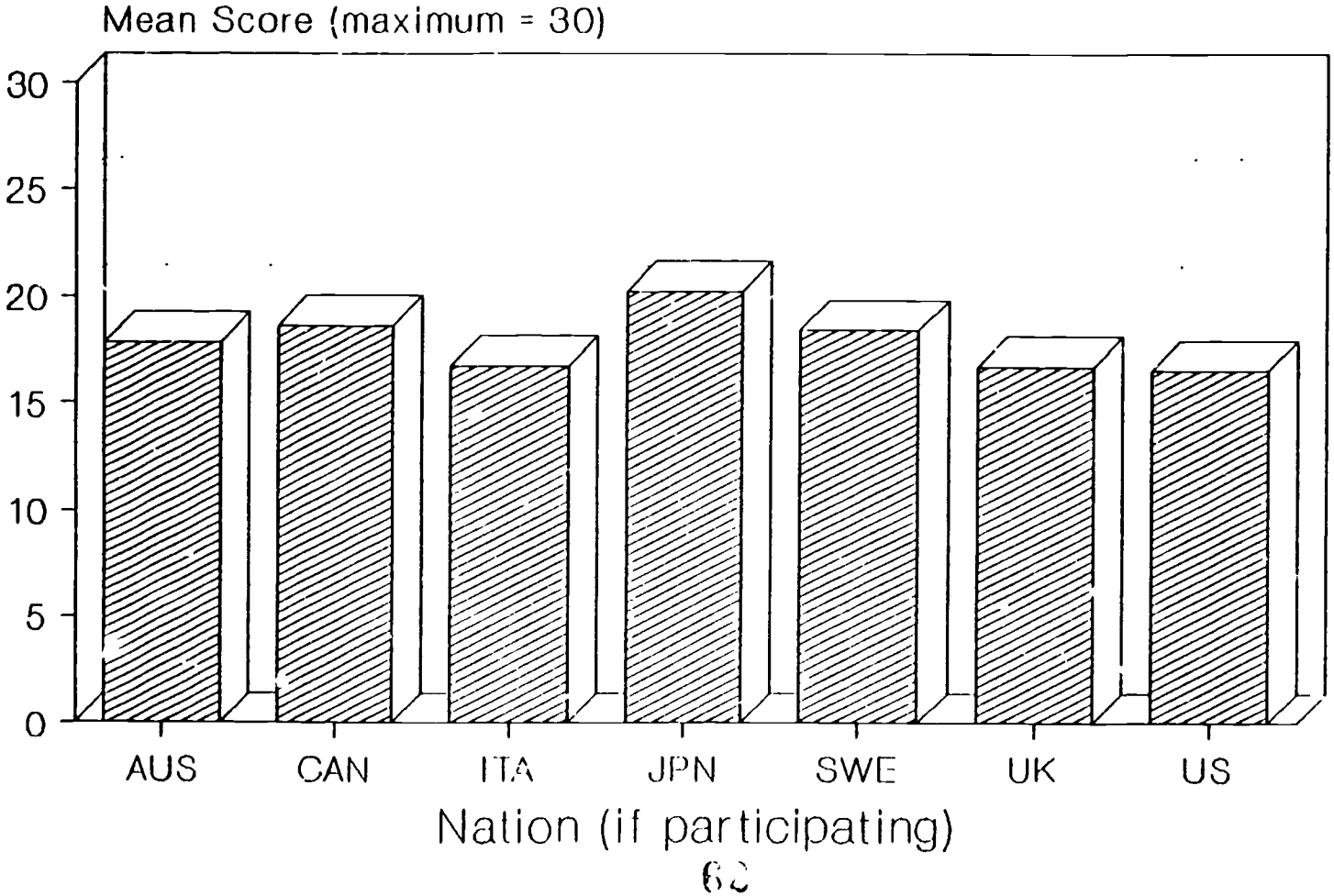


TABLE 14. Mean (Average) Science Achievement Test Scores for Pupils in Population 3 (17-year olds in the United States), 1983-86

Nation	Percent correct, biology	Percent correct, chemistry	Percent correct, physics
Australia	48.2	46.6	48.5
Canada a/	45.9	36.9	39.6
China	na	na	na
Federal Republic of Germany	na	na	na
France	na	na	na
Italy	42.3	38.0	28.0
Japan	46.2	51.9	56.1
Mexico	na	na	na
Soviet Union	na	na	na
Sweden	48.5	40.0	44.8
United Kingdom b/	63.4	69.5	58.3
United States	37.9	37.7	45.5

a/ Includes pupils in English-language Canadian schools only.

b/ Includes pupils in English schools only.

Based on tests developed by the International Asscciation for the Evaluation of Educational Achievement, and administered during the period of 1983-86.

Source: Science Achievement in Seventeen Countries, A Preliminary Report. p. 51-53.

SCIENCE ACHIEVEMENT
Population 3 (17-year olds)

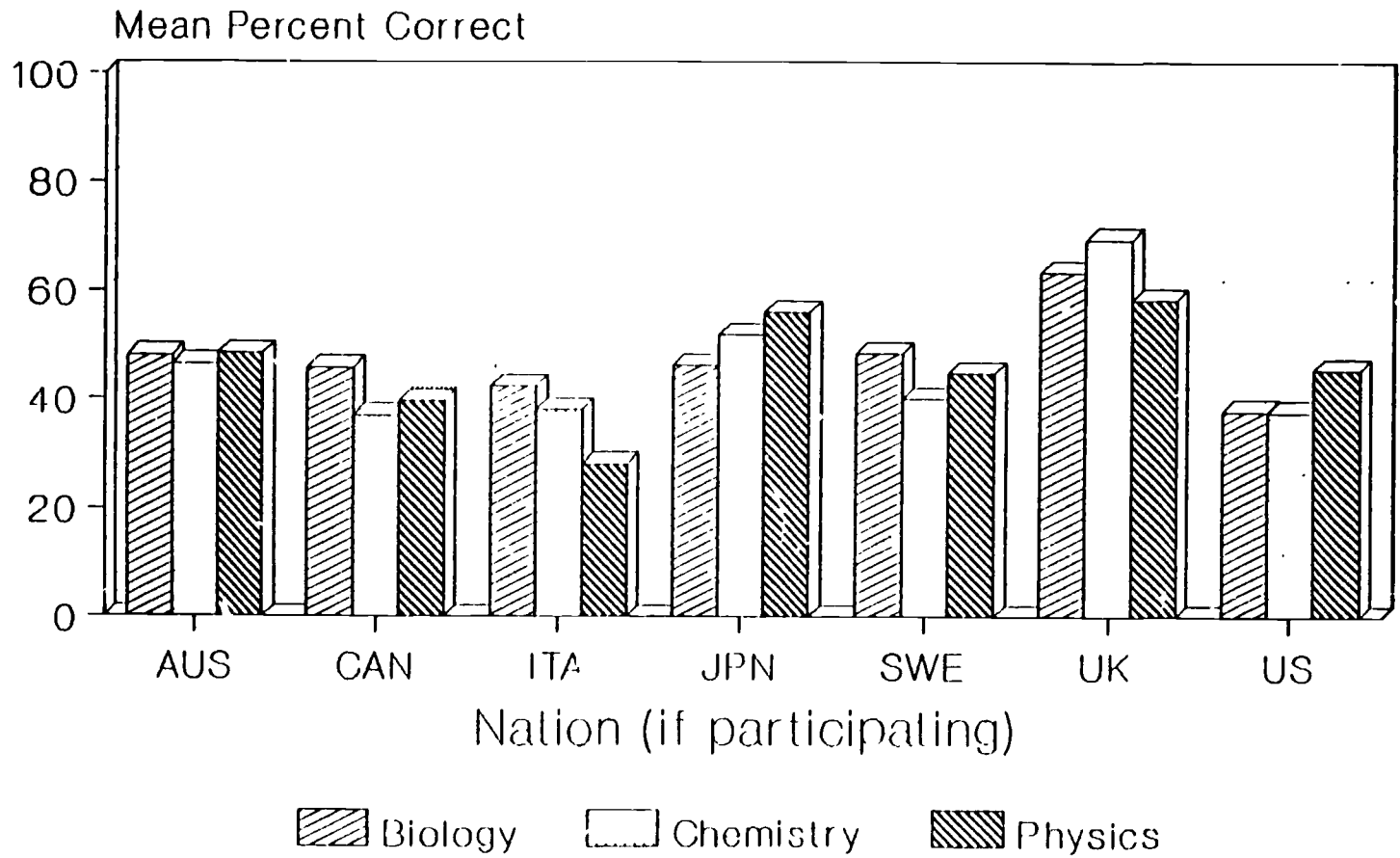


TABLE 15. Mean (Average) Mathematics Achievement Test Scores for Pupils in Population A (13-year olds) and Population B (17-year olds in the United States), 1982

Nation	Percent correct, population A	Percent correct, population B
Australia	na	na
Canada a/	50.9	44.5
China	na	na
Federal Republic of Germany	na	na
France	53.6	na
Italy	na	na
Japan	63.6	70.2
Mexico	na	na
Soviet Union	na	na
Sweden	43.4	57.5
United Kingdom b/	48.8	51.3
United States	46.2	39.8

Based on tests developed by the International Association for the Evaluation of Educational Achievement, and administered in 1982. The scores are unweighted averages (means) for each nation of scores on each of the mathematics tests given at each age level. c/

a/ Average of scores for the Provinces of British Columbia and Ontario.

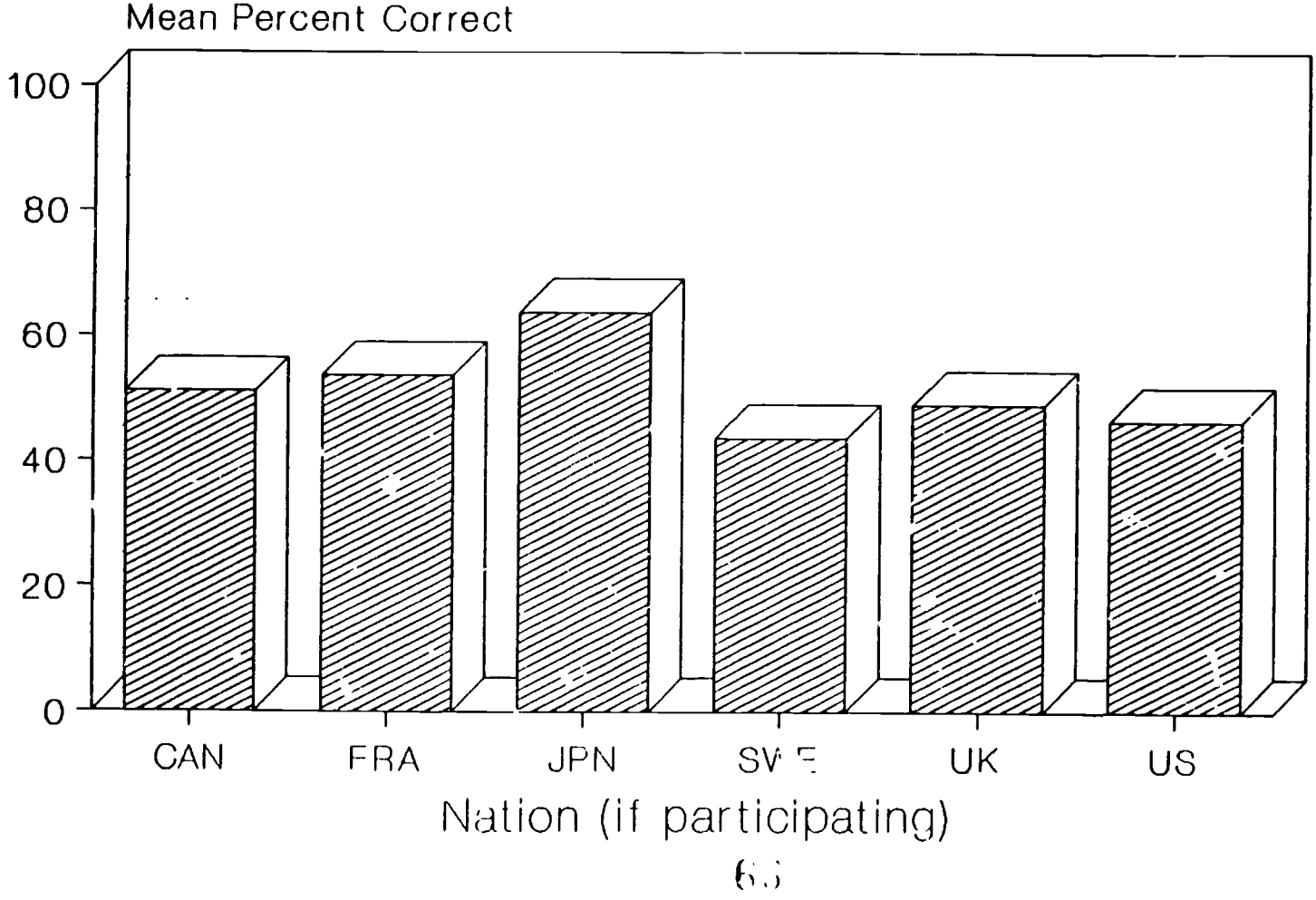
b/ Average of scores for England/Wales and for Scotland.

c/ For population A, tests were given in arithmetic, algebra, geometry, statistics, and measurement. For population B, tests were administered in number systems, sets and relations, algebra, geometry, elementary functions and calculus, plus probability and statistics.

Source: The Underachieving Curriculum, p. 124-125.

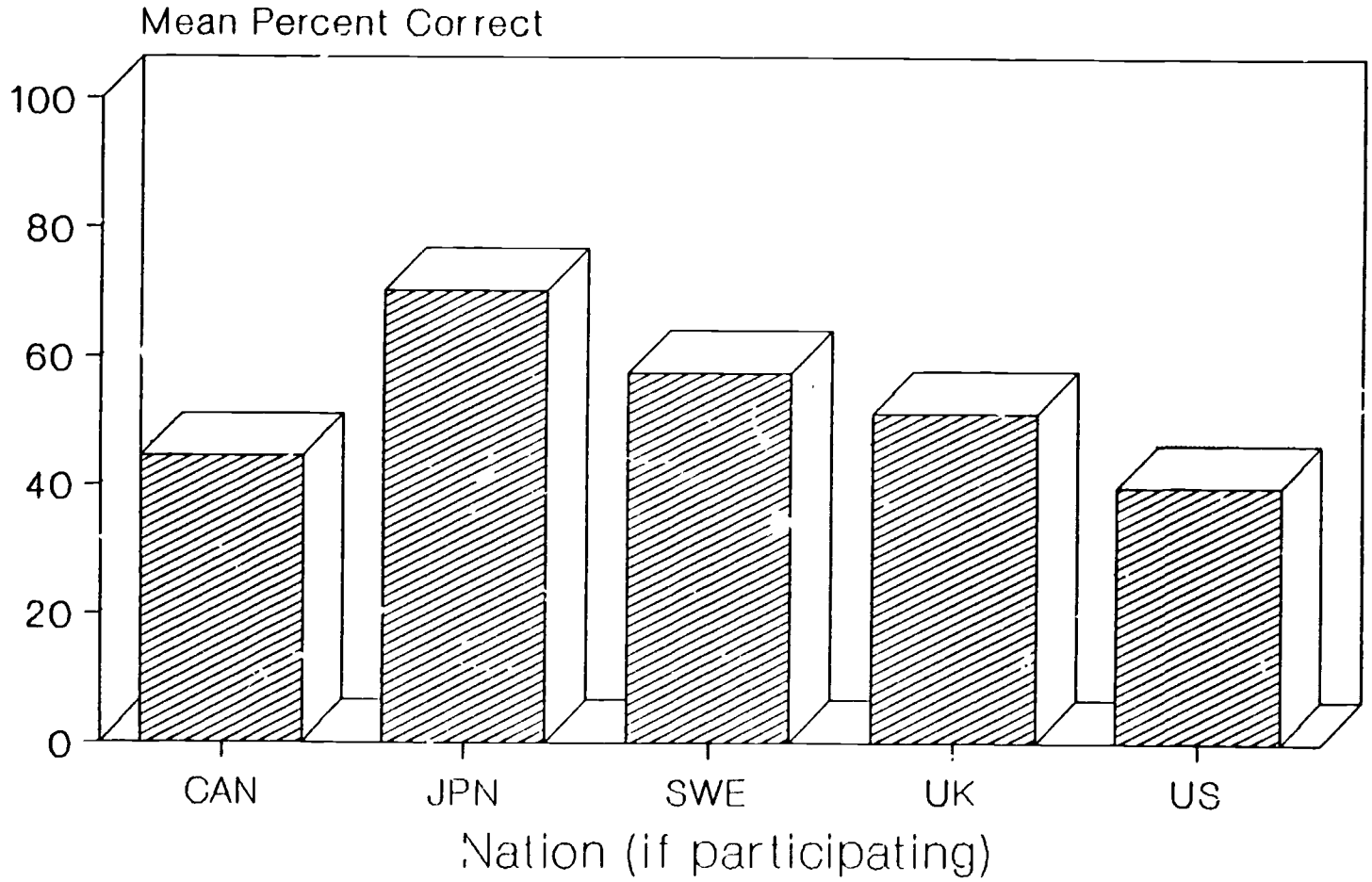
MATHEMATICS ACHIEVEMENT

Population A (13-year olds)



MATHEMATICS ACHIEVEMENT

Population B (17-year olds)



SECTION B: DISCUSSION AND ANALYSIS

Discussion of Findings

The third section of tables and graphs contains summary information from the limited number of current surveys of comparative educational achievement that are generally considered to be reliable and valid. These surveys of mathematics and science achievement, at the upper primary and secondary levels, were conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA).

IEA Test Process

The IEA, founded in 1961, sponsored the preparation, administration, and analysis of a series of examinations in mathematics, science, reading comprehension, literature, civic education, and French and English as foreign languages, to pupils at 3 age/grade levels in 12-20 countries (depending on the specific test and age/grade level) between 1964 and 1970. These findings are currently being supplemented by the results of a second round of IEA tests in mathematics, science, and written composition, plus an IEA survey of preprimary education programs. Thus far, results are available only for the second round IEA tests in mathematics and science, and these findings are presented in tables 13 through 15, plus the accompanying graphs.[18]

The IEA tests are designed for students at specific age/grade levels: for the science tests--population 1 (10 year-olds), population 2 (14 year-olds), and population 3 (students in their final year of secondary school, see below); for the mathematics tests--population A (13 year-olds), and population B (students in their final year of secondary school, see below). There are no IEA, or other valid, tests of the comparative achievement of postsecondary students or graduates. Another significant--and for purposes of making valid international comparisons, troubling--aspect of the selection of population groups to be tested is the variation among nations with respect to population 3/B, students in their final year of secondary school. First, in certain nations with extended upper secondary education programs for students intending to attend a university (such as France, England/Wales, Italy, or the Federal Republic of Germany), the pupils in this population will be in their 13th (not 12th, as in

[18]An IEA assessment of written composition has been conducted, but international scores and analyses are not yet available. It has also been proposed that the IEA conduct an assessment of reading comprehension. This proposal is currently in an early stage of development. Finally, the National Assessment of Educational Progress, a U.S. Government-funded program conducted by the Educational Testing Service (ETS), has recently administered a pilot test of science and mathematics achievement to 14-year olds in the United States plus Italy, Spain, England, South Korea, and two Canadian Provinces. Results of this pilot test are not yet available.

the United States or Japan) year of full-time primary-secondary education.[19] The wide variation among nations in the proportion of youth who attend academically-oriented or comprehensive--as opposed to separate vocational upper secondary schools, or none at all--is probably of greater significance. The importance of this factor in the interpretation and analysis of the IEA results for students in their last year of secondary school will be discussed further below.

There are several reasons why the IEA examinations represent the only comparable, multination achievement tests that are available, and why even the IEA tests have been so infrequently administered.[20] In order to be valid, fair and comparable, such tests have to be developed via an extensive process involving educational testing specialists from each of the participating nations. The tests should maintain a balance between establishing international standards regarding what pupils should know in certain subject areas at specific age levels, while attempting simultaneously to reflect the actual curriculum of each country in an approximately equal proportion (i.e., ideally, the pupils in each country should have been exposed to an equal proportion of the material covered by the tests). These difficulties are exacerbated by differences in language, culture, and curricular emphasis among countries. Only the IEA tests are generally considered to have successfully resolved these difficulties.

In addition, the costs of developing, administering, and compiling/analyzing the results of the tests are considerable, and secure sources of these funds generally have not been available (United States participation has been supported by a combination of foundation, United States Office/Department of Education, and National Science Foundation grants). Further, students vary widely among countries in their familiarity with testing procedures or experience in taking national or international tests; international tests may measure such "test wiseness" as much as mastery of the substantive material covered by the test. Another potential source of difficulty is political--for example, nations may choose not to participate for fear of low scores. Of the 12 nations covered by this report, only 7 participated in the IEA second round

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[19]For a detailed discussion of this topic see, U.S. Library of Congress. Congressional Research Service. Public Secondary Education Systems in England, France, Japan, The Soviet Union, The United States, and West Germany: A Comparative Analysis. Report No. 84-770 EPW, by Wayne Riddle. Washington, 1984.

[20]One possible additional source for future information on comparative educational achievement is the National Assessment of Educational Progress (NAEP). The NAEP is a federally-funded program for evaluating the achievement of American pupils in a variety of subject areas. NAEP and Department of Education officials are currently considering the feasibility of administering certain NAEP tests to representative samples of pupils in selected foreign nations, and are conducting a pilot project in this area (see footnote[18]).

science tests and 5 (population B)/6 (population A) in the second round mathematics tests. Finally, numerous timing, coordination, and methodological problems hamper any such international testing effort.

In the future, additional evaluation of the meaning and value of IEA or other international achievement comparisons may be provided by a Board on International Comparative Studies in Education. This Board was recently established within the National Research Council of the National Academy of Sciences, and is supported by grants from the National Center for Education Statistics (of the Department of Education) and the National Science Foundation. It is intended that the Board will assist in planning, reviewing, and disseminating comparisons of American educational achievement with that of foreign nations.

Science Achievement

Table 13 displays average (mean) national scores on the IEA second round (1983-86) test of science achievement for populations 1 (10 year olds) and 2 (14 year-olds). At both of these age levels, the range of scores is relatively small--from 11.7 to 15.4 (out of a maximum of 24.0) for population 1, and from 16.5 to 20.2 (out of a maximum of 30.0) at population 2. The score for United States' students was approximately average for the 7 participating nations at population 1, but was lowest (although only 0.2 points below 2 other nations) for population 2. At both age levels, Japanese students received the highest average scores.

Science achievement scores for students in population 3 (students in their final year of secondary school) are shown in **table 14**. Unlike the aggregate science scores for populations 1 and 2, the population 3 scores are reported separately for students in the subjects of biology, chemistry, and physics. At the population 3 level, the range of scores in each subject is somewhat wider than for populations 1 and 2, even after accounting for the fact that population 3 scores are reported in terms of percent, rather than number, of questions answered correctly. In the population 3 test in biology, the United States' scores were lowest among the nations included in this report, while students in the United Kingdom received by far the highest scores. In chemistry, the results for students in the United States were above those for Canadian students, but trailed those for the other five nations. Again, students in the United Kingdom received scores well above those for other nations. Finally, in the population 3 physics test, United States students' scores were relatively higher--at approximately the average for the seven participating nations--while scores were again highest for students in the United Kingdom, followed closely by the scores for Japanese students.

Mathematics Achievement

Finally, **table 15** contains results from the IEA second-round (1982) tests in mathematics. Although test results are available in a wide range of specific topic areas, only the average of scores on all tests for each age/grade level are included in this table. Of the 6 nations participating in the tests for population A (13 year-olds), scores were highest for Japan and France, lowest for Sweden and the United States. Of the five participating nations for population B (students in their final year of secondary school), scores were again highest by a substantial margin for Japan, and were lowest for the United States.

Thus, summarizing the currently-available IEA achievement test scores for the United States, in comparison to those nations included in this report that participated in each test, the United States' scores were at approximately the average in science for the youngest students tested and for high school seniors in physics. United States students' scores were among the lowest in science for 14 year-olds, chemistry and biology for high school seniors, and in mathematics at both age-grade levels. Among other nations, scores were highest for Japan in science for 10 and 14 year-olds and in mathematics for both age/grade levels, but students in the United Kingdom received the highest scores in all three science subjects for students in their final year of secondary school.

Analysis

The meaning and implications of the scores of United States students on the second-round IEA tests in mathematics and science are limited by the availability of scores only in these two subject areas, and only for students in the upper primary and secondary grade levels. While mathematics and science are major subjects, they represent only a portion of the primary/secondary curriculum, and one should resist the temptation to extrapolate from test scores in these subjects in judging the overall quality of American education.

Information from the second round IEA tests may be supplemented by results from the wider range of first round tests, which were administered between 1964 and 1970. While the first round results are obviously dated, the patterns of United States pupils' scores are quite similar to those in the second round tests in subjects where scores are available for both rounds. Scores for the United States in the first round of IEA tests, compared to economically developed nations in general, may be briefly summarized as follows:[21]

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[21]For more details, see U.S. Library of Congress. Congressional Research Service. Comparison of the Achievement of American Elementary and Secondary Pupils with Those Abroad--The Examinations Sponsored by the International Association for the Evaluation of Educational Achievement (continued...)

- -- Scores for the United States were relatively lower at higher age/grade levels in all subject areas;

- -- U.S. scores were particularly low in mathematics and foreign language (French);

- -- Scores for students in the United States were relatively high in science at population 1 (10 year-olds), and reading comprehension, literature, and civic education at population 2 (14 year-olds); and

- -- U.S. scores were at roughly the international mean for reading comprehension at population 1 (10 year-olds), science at population 2 (14 year-olds), and literature at population 3 (students in their final year of secondary school).

Thus, the general impression of United States pupils' performance one derives from the first round IEA test scores is that it ranks somewhat below the average for more developed countries, albeit with relatively higher performance at earlier grade levels in certain subjects (such as reading and science), but particularly low scores in mathematics and French as a foreign language. With respect to other more developed nations, there was no highly consistent pattern of certain nations being at the top or bottom on the basis of the first round IEA test scores. However, this conclusion rests partially on the choice of some nations not to participate in all subjects and at all age/grade levels--for example, Japan's performance is among the highest in most of the tests and levels at which it participated, but it did not participate in all of these.

In seeking an explanation for the performance of American students on the IEA tests, analysts have considered four major types of information, each of which will be discussed briefly below:

- -- arguments that achievement is highest in nations with selective and differentiated systems of secondary education;

- -- analyses of specific aspects of the mathematics curriculum in the United States, compared to those of other developed nations;

- -- evidence regarding school system resources and practices, especially on total time spent in school and proportion of that time devoted to mathematics and science education, gathered as a supplement to the first and second round IEA tests; and

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[21](...continued)
(IEA). CRS Report for Congress No. 86-683 EPW, by Wayne Riddle. Washington, 1986.

-- arguments regarding the major values implicit in the structure and governance of American education, compared to those dominant in other highly developed countries.

It should be emphasized that each of these potential explanations of the performance of American students can be only partial, and it is not possible to definitively determine their relative significance. These possible explanations are reviewed here primarily to aid in the reader's understanding of the debate over the relative academic achievement of American pupils, and provide perspective on these issues.

Selectivity of Secondary School Systems

One focus of attention in analyzing the United States' scores has been the development of methods to adjust the population 3/B (students in their final year of secondary school) results to account for the varying proportions of the participating nations' youth included in the sample of pupils tested. It has been traditional in most of the western European nations for only those who intend to enroll at a university to complete an academic upper secondary education. Further, in such nations as the Federal Republic of Germany, France, and the United Kingdom, students in population 3/B are in their 13th year of full-time primary/secondary education, not their 12th as in the United States or Japan. Especially at the time of the first round tests, other pupils in these countries would be directed to vocationally oriented secondary schools or apprenticeship programs, or would already be in the work force before the terminal year of pre-university secondary education. However, in the United States, all students in the 12th grade in our comprehensive high schools, except the small proportion in separate vocational schools, have often been considered to be in population 3/B for the IEA tests, especially the first round tests. Thus, the population from which a sample of students was tested has sometimes been substantially broader and younger in the United States than in other nations.

Further evidence in favor of the secondary school selectivity argument comes from the second round IEA tests in mathematics and science. Among the nations included in this report, the highest scores in each of these mathematics and science tests were earned by students in Japan or the United Kingdom. Japanese education is comprehensive at the primary and lower secondary (grades 7-9) levels; and is generally comprehensive for upper secondary (grades 10-12) education in that students are not generally assigned to wholly separate types of schools for vocational, college preparatory, and general secondary education. However, Japanese upper secondary education is selective in that students take competitive entrance examinations to enter one of several schools in their locality, and appear to be steered by teachers and guidance personnel to schools deemed to be appropriate to their level of academic ability. The result appears to be a hierarchy of upper secondary

status levels, with a substantial degree of homogeneity in student achievement within each school.[22]

In the United Kingdom--more specifically, England and Wales--there has been widespread movement toward establishment of comprehensive secondary schools, but generally only those intending to attend a university enroll in the full 13-year elementary and secondary program, and a number of students still attend selective, college preparatory, "grammar" schools. Perhaps more importantly, students in academic upper secondary schools of whatever type are encouraged to specialize in specific subject areas--in preparation for the national, subject-specific, graduation/college entrance examinations--to a much greater extent than do the great majority of American secondary school students. Such secondary-level specialization, which is usually delayed until postsecondary education for American students, may largely explain the high scores of British students on the IEA science tests for population 3.

However, arguments that population 3/B scores should be adjusted to account for national differences in the selectivity of secondary school systems are less relevant to the second round, than they were to the first round, IEA scores. In both mathematics and science, the test samples of United States' students in the second round tests were selected from the minority of students taking one or more relevant courses in their final year of high school--i.e., for the science test, those taking a science course in their senior year, and for the mathematics test, those taking a college preparatory mathematics course in their senior year of high school. Consequently, for the population B mathematics test, the group of American students from whom the test sample was selected included only 13 percent of all 17 year-olds, which was somewhat below the (unweighted) average for all developed nations participating in the test.

Nevertheless, an additional adjustment for school system selectivity has been applied to the second round IEA test scores in mathematics.[23] Scores were compiled separately for students in the United States taking calculus versus pre-calculus, but still college-preparatory, mathematics courses in their senior year of secondary school. The scores for the calculus students--presumably the United States' ablest mathematics students in high school--were at approximately the international average (median) rank for all students. In other adjusted comparisons of the scores of only the top 5 or 1

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[22]Rohlen, Thomas P. The Japanese High School.

[23]Such an adjustment was also applied to scores in the second round science test, with scores separately reported for students who were/were not enrolled in a science course in their final year of secondary school. However, the United States did not participate in this part of the data collection and evaluation process--i.e., all American students participating in the population three science test were enrolled in science courses--so the effects of this adjustment cannot be discussed with respect to the United States.

percent of students in each nation, scores for students in the United States were below those for most other developed nations.[24]

Specific Analyses of Mathematics Education in the United States

In a recent report, the coordinators of United States participation in the second round IEA tests in mathematics[25] examined several possible explanations for the relatively disappointing performance of American students.[26] The authors of this report argue that certain explanations frequently offered for the test scores of American students do not actually or effectively explain American scores on the IEA mathematics test, or at least provide only very partial explanations. Among the potential explanations considered to be erroneous and "deceptive" by the authors of this report are: (a) that students in the United States spend substantially less time in mathematics instruction than those of other nations; (b) that class size is relatively large in the United States; (c) that comprehensive secondary education systems, such as that in the United States, are associated with lower achievement levels than are selective systems; and (d) that American mathematics teachers are less prepared than those of other developed nations.

In contrast, the United States coordinators of the second round IEA mathematics tests argued that American students' performance was relatively low because of: (a) wide variation in coverage of mathematical topics in different American schools; (b) low intensity of curriculum content, with heavy emphasis on repetition and review; (c) overemphasis on arithmetic, as opposed to more advanced mathematical topics, in junior high school; (d) tracking of students into mathematics courses of widely differing content and quality; (e) relatively undemanding textbooks, and little use of other instructional resources; (f) relatively little use of calculators or computers in instruction; (g) relatively low status and rewards, and large numbers of classes, for teachers; and (h) the separation, or "fragmentation," rather than integration, of mathematical topics over different years of instruction.

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[24]For a more detailed discussion of the results of these score adjustments, see The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective. p. 23-27.

[25]In contrast, the United States coordinators of the second round IEA science tests have thus far published only preliminary analyses of possible explanations for the relative scores of American students. Additional science score analyses are planned for future publication. See International Association for the Evaluation of Educational Achievement, Science Achievement in Seventeen Countries, A Preliminary Report.

[26]The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective.

IEA Analyses of School System Characteristics

Information on pupil and school background characteristics has been gathered as part of the IEA testing process. In analyses of the (thus far, primarily) first round IEA test results, different types of background characteristics were examined to determine whether they significantly influence pupil achievement in between-country, as opposed to between-school or between-student, analyses. The background data considered in the between-country analyses were intended primarily to help explain nationwide influences on average achievement, as opposed to more specific influences of particular home and school characteristics, without regard to national boundaries, which are most often the focus of analyses of the sources of varying school achievement.[27] Due at least partially to certain methodological limitations (see footnote [27]), very few of the background factors were found to significantly affect achievement in comparisons between countries. In fact, the only consistently significant influence was found to be "opportunity to learn" or "time on task," the amount of time devoted to a particular subject area in the typical curriculum in each country.[28]

Thus, the especially low scores of American students in mathematics and (first round) foreign languages might result largely from a comparatively low emphasis given to those subjects in American schools. In the same fashion, it is argued that the relatively high scores of American pupils in reading comprehension and literature at certain age/grade levels in the first round IEA tests might have resulted from the relatively heavier emphasis on those subjects in American schools. Additional analysis focusing on the relationship between achievement growth and emphasis on science versus reading in the curricula of various countries for populations 1 and 2 has been published by James Coleman.[29] Coleman found evidence in pupil achievement growth of

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[27]This intent is reflected in the attribution of school average or even national average values of certain background variables to pupils, regardless of whether those values were appropriate for those individual pupils, in between-country analyses. This construction may have sharply limited the value of the data gathered for any further analysis because it greatly limited the degree of variation of the background characteristics (statistically, the less variation of these "independent variables"--or background characteristics--the less they can be used to explain variation in the "dependent variables"--in this case, the achievement test scores).

[28]In at least some subject areas, home and student background characteristics (family income, education, etc.) were found to most significantly influence achievement in between-school or between-student analyses. For example, see Comber, L. C., and John P. Keeves. Science Education in Nineteen Countries. Chapters 7-9.

[29]Coleman, James S. International Comparisons of Cognitive Achievement. Phi Delta Kappan, Feb. 1985. p. 403-406.

an emphasis on science education in England, Scotland, Sweden, Hungary, Japan, and the Federal Republic of Germany.

Additional research on the proportion of school time that American primary pupils spend on mathematics and science, as well as on the efficiency with which all instructional time is used in American schools, compared to schools in Japan and Taiwan, has been conducted by Harold Stevenson of the University of Michigan.[30] In his evaluation of a sample of primary school pupils in these three nations, Stevenson found that reading achievement is relatively similar among the three countries (and becomes more so at higher primary grade levels), but the United States' performance is distinctly behind that of the other two countries in mathematics at all grade levels. This repeats a pattern evident in the IEA findings of relative strength of the United States' performance in reading but weakness in mathematics achievement. This impression is further corroborated by findings from the University of Michigan study that American pupils in the fifth grade spend much more of their class time on reading lessons than do pupils in the other countries (41.6 percent in the United States compared to 24.0 percent in Japan and 27.6 percent in Taiwan); and less on mathematics (17.2 percent for the United States compared to 23.4 percent in Japan and 28.2 percent in Taiwan). This finding is also consistent with IEA conclusions on the importance of time on task and curricular emphasis in explaining achievement patterns.

Of special interest are the findings of the University of Michigan study regarding classroom environment and activities. Certain conventional measures of quality of educational inputs--especially class size and such formal teacher qualifications as degrees or years of education--were found to be more favorable in the United States. However, the researchers found substantial differences among the countries in the proportion of class time actually devoted to academic pursuits. They determined that in their sample of American classrooms, the average pupil spent less than one-half of his or her time paying attention to academic instruction (45.3 percent for the first grade and 46.5 percent for the fifth), while pupils in Japan and Taiwan spent approximately two-thirds or more of their time so engaged (66.2 percent and 64.6 percent for the first and fifth grades in Japan, 65.0 percent and 77.7 percent for these grades in Taiwan). American teachers were judged to be imparting information to their pupils only 21 percent of the time, compared to 33 percent in Japan and 58 percent in Taiwan. Combined with the longer school year in the two Asian countries (the average school year is approximately 240 days in Japan and Taiwan compared to 180 days in the United States), this leads to substantially greater aggregate time spent on academic activities in Japan and Taiwan.

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[30]See, among other publications, Stevenson, Harold, et al. Child Development and Education in Japan, 1986.

American Educational Values

Finally, others have looked to broader aspects of the values of American education that they consider to be implicit in its structure and governance to help explain relative American scores on the IEA tests. Primarily, these analysts argue that the historical emphasis of American education on broad access, equity, and equal opportunity has resulted in at least some diminution of the ability to maintain relatively high academic standards. They state that several other nations' education systems are more willing to maintain high standards, even at the expense of refusal of opportunity to a large proportion of their population to obtain the sort of education they might desire.

As examples of these contrasting values, observers have pointed to: the standard-setting and, to a large extent, curriculum-directing role of national examinations for high school graduation in many foreign countries compared to only minimal competency examinations in certain American States; the rigorous competition for a limited number of college placements in several countries compared to the availability of some form of postsecondary education to virtually every high school graduate in the United States who desires to attend college (albeit with sharp competition for high prestige colleges); a purported lack of widely agreed upon and clearly articulated expectations of high academic achievement in such a heterogeneous nation as the United States; and a greater emphasis on nonacademic courses in the United States than abroad.

Further information regarding educational values and perceptions in the United States may be found in the research described above by Harold Stevenson and others, comparing American primary students and their families with those in Japan and Taiwan.[31] While this research is severely limited by its inclusion of only the United States and one other nation of the group of 12 covered in this report, it is briefly described here because of its reliance on detailed surveys of a sample of pupils and parents in each of the 3 nations. Ironically, in view of the lower performance of American pupils in the Stevenson study, a survey of their parents indicated a higher level of satisfaction with their children's schools and academic progress than was the case for Japanese or Taiwanese parents. While 92 percent of American mothers rated their children's schools as "good" or "excellent," such ratings were given by only 39 percent of Japanese mothers and 42 percent of those in Taiwan. It was also determined that American parents are less willing

[31]Stevenson's research has been described in a number of publications. Among these are the following journal articles: Stevenson, Harold, Shin-Ying Lee, and James W. Stigler. Mathematics Achievement of Chinese, Japanese, and American children, Science, Feb. 14, 1986. p. 693-699; and Stevenson, Harold, Shin-Ying Lee, James W. Stigler, G. William Lucker, Seiro Kitamura, and Chen-chin Hsu. Cognitive Performance and Academic Achievement of Japanese, Chinese, and American Children. Child Development, v. 86, 1985. p. 718-734.

than those in the other countries to push their children to improve their level of achievement; and that American parents are more likely to assign non-academic chores to their children while Japanese and Taiwanese parents are more concerned to leave their children free to pursue homework and other academically related activities at home. Compared to Japanese and Taiwanese children, American first- and fifth-graders were found to spend more out-of-school time playing, performing household chores, or sleeping, but less time on homework or reading for pleasure. However, Japanese children were found to spend the most time watching television

Interesting differences were found by Stevenson among the three nations in the extent to which mothers attributed academic performance to pupil effort versus native ability. Compared to the two Asian nations, American mothers were more likely to emphasize ability, rather than effort, as a basis for success in school. It was suggested that, "[T]he willingness of Japanese and Chinese children to work so hard in school may be due, in part, to the stronger belief on the part of their mothers in the value of hard work."[32] There were significant differences in education-related resources in the home; e.g., while fewer than two-thirds of the United States pupils had study desks at home, more than 95 percent of the Japanese and Taiwanese pupils had such desks. Further, Japanese and Taiwanese mothers reported spending more time assisting in and supervising their children's homework.

Objective evaluation of the arguments discussed in this report section is in many cases impossible, since they are often based on subjective judgments. Certainly, education in the United States is governed and financed in a much more disaggregated fashion than in most other of the highly developed countries, yet this more clearly is likely to lead to a wider range of achievement levels in the United States, as does appear to be the case from the IEA data, than a lower average. The effects of national examinations and of higher degrees of cultural homogeneity are so difficult to specify in concrete terms that they have not been satisfactorily evaluated empirically or objectively.

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[32] Mathematics Achievement of Chinese, Japanese, and American Children. Science, Feb. 14, 1986. p. 697.